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OHIO ELECTRIC LIGHT CONVENTION.

Elsewhere we print a report of the annual convention of the Ohio Electric Light Association, one of the oldest and best of our State electric light organizations, which was held last week at Put-in-Bay, Ohio. While the discussions were not as long as at some of the other State conventions, a formidable array of papers was presented, several of which have more than an ephemeral value. The meetings of the Ohio association for a number of years appear to have been a favorite place for representatives of manufacturing companies to present literature relating to new devices. It is perhaps a matter worthy of consideration how far an association of this kind can wisely allow its programmes to be largely taken up by this type of papers. In saying this we do not reflect on the quality of such papers, for they usually contain much information of practical commercial and engineering value, and their preparation for presentation to an association of this kind often leads to the getting together in convenient form of a lot of useful information on commercial devices which might not otherwise be readily obtainable. Nevertheless, such information might as easily take the form of a manufacturer's bulletin, and there is much truth in the remark of a delegate at the present convention, to the effect that information about new apparatus is easy for any central station man to obtain from the manufacturer direct without presentation at an electric light convention, while information on the practical details of the management of a central station cannot be exchanged with as much facility as at conventions, and consequently papers on such subjects are what the central station man most needs. The history of electric light associations seems to bear out this idea, as it is notable that the most successful associations are those which have confined themselves mainly to discussions by members of papers written by members, with an occasional contribution from the supply man's contingent by way of variety. The moment an association begins to get away from this idea and comes to depend too much on manufacturing and supply companies for papers, the real interest begins to wane. Fortunately, the programme of the Ohio association usually contains numerous papers written by members in addition to those originating in manufacturing companies.

It is interesting to observe the various kinds of competition over which the central station men in various States are worrying at different times. Just now a great surplus of cheap natural gas in Ohio is putting up about as stiff a proposition for electric light companies to meet as any companies in the country have ever had to encounter. Natural gas competition struck Indiana some years ago, but is there now on the wane. In Iowa a few years ago the consumer's private gasoline plant and the individual gasoline "arc" were sources of alarm. It is gratifying that electric lighting has survived all these threatened forms of competition, and the outlook has never appeared brighter than at present. While the situation in Ohio is momentarily somewhat unpleasant for the central station men of that State and their minds are evidently much engaged in devising methods to meet the competition, we are confident that electric lighting will continue to hold more than its own just as it has in the case of all previous similar competitions. In spite of the apparent cheapness of natural gas, the expenses occasioned by its smoke and dirt and its inconvenience as compared with electric light, are strongly against it, and these are powerful weapons in the hands of the electric light men. The question of rates to meet cheap gas

competition and yet give a proper return on investment, naturally received considerable attention at the convention, but it was quite evident that on this subject the average central station man yet requires much education to broaden his views sufficiently to enable him to cope fully with the situation which the modern rate question presents. It seems, however, that the first step toward a rational system of rates is the adoption of a system of bookkeeping that will enable every item entering into cost to be segregated. Until this is done the central station man should proceed with caution in adopting any of the complicated systems of rates, even though successfully used elsewhere, for he cannot proceed safely until he has submitted a system to an analysis involving consideration of all local cost and other factors.

A State association like that of Ohio could in this particular be of immense service by devising a system of cost keeping and having printed for issue to members complete sets of forms and books for putting it into execution. It is true that such a system would probably not be equally suitable for every central station in the association, but however much it might fall short in a specific case, it would be enormously better than none at all. Moreover, its use would impart the fundamentals of modern central station accounting, and changes suggested by special conditions could then safely be introduced later. In a most interesting preliminary report to the association, Messrs. Bechtel, Miller and Perkins submitted a draft of a system of cost accounting which might well be put in final shape and placed at the disposition of members in the practical manner above suggested. We fear that unless some action is taken along these lines very few central stations will of their own initiative take up a system involving the complication—in appearance, at least—inseparable from rational cost accounting. In that submitted, for example, there are 14 heads under construction accounts, and 39 heads under general generating and distribution costs. With, however, the privilege of appealing in cases of doubt to a committee of the association appointed to advise members in the matter, and with opportunity to consult with other central stations taking up the system, all but the inevitable weakling would in due time and greatly to their advantage, master this important adjunct to profitable central station working.

LEGIBILITY OF ELECTRIC SIGNS.

In the tremendous growth of the electric sign business which has taken place in nearly all the large cities of the United States the past few years, it is but natural that sufficient attention has not been given to what may be designated as the engineering side. In other words, there has been too much of a tendency to stick a lot of incandescent lamps into a sign without regard to how they are placed or whether the sign is or is not legible at a reasonable distance away. The essential object of any electric sign is to make certain letters or designs stand out so that they can be read. If a sign fails to do this it has no excuse for being as far as its owner is concerned. There are hundreds of electric signs to be seen on our streets to-day which are equipped with enough lamps to make the sign easily legible a block or more away, but which can hardly be read at a distance of 150 ft. The cause of the illegibility is usually a blurring together of the lights, and how to avoid this defect is a question of sign design that can be handled in a number of different ways. It is certainly time that some attention were given to this matter, for the waste of money in illegible signs is at present altogether too great. If the reader is unconvinced, let him walk down the streets of any of our large cities some evening and count the number of large electric signs that cannot be read over a half or a quarter of a block away.

MODERN ELECTRIC LIGHTING.

It would take a regiment of Yankees to guess the future of electric lighting from the present tendencies of lighting practice. The only really safe prediction is that there will be a steady increase in the business, since the gravest objection now urged against the electric light is that one cannot light his pipe at it—at least since the disappearance of the open arc from current practice. But as to the form of lighting that we will have five or ten years hence, the wise prophet is silent, and squares accounts by looking wise and ruminative. Five years ago he gave welcome to the passing of the open arc, and cheerfully staked his reputation upon the incandescent lamp, but now he is badly tangled again. For the flaming arc is on the rampage in out-of-the-way stations, the mercury arc sheds its intense greenery-yallery effulgence on unexpected street corners, and the Nernst lamp glows indoors and out at unexpected points. Then the tantalum lamp and the osmium lamp and the zirconium lamp are coming into sight, with the vacuum tube lamp shimmering behind them. It is enough to make any conscientious seer shudder. And the station manager who makes no professions as a prophet, but merely keeps his ear to the ground, is not a little disconcerted at the uncertain messages that he receives.

Some little certainty, however, can be made out from existing conditions. It is unquestioned that the new illuminants have an additional advantage in efficiency that cannot be put aside for any merely sentimental considerations, nor kept in the background by any commercial maneuvering. In the long run the consumer will find a way of obtaining the advantages of increased efficiency whether the station manager welcomes the change or not. And in the long run, too, it will pay the latter to adopt the more efficient forms of illuminant since the ultimate result of cheap light is a greatly increased demand. But the central station man is keenly interested in one thing for which the consumer, save in cases where he furnishes his own renewals of incandescent lamps, cares not a straw, to wit: the cost of up-keep. The enclosed arc lamp was from the standpoint of energy consumption a step backward, yet its introduction cut the labor cost, in this country, so much that the old open arc is now almost as hard to find as an overshot water wheel. Now, however, comes the flaming arc with so prodigious a saving in energy as to make it necessary to strike a new balance sheet. And the Nernst lamp, undoubtedly of better efficiency than the alternating-current, enclosed arc, is also pushing ahead, and is held back mainly by doubts as to its real maintenance cost. From figures recently reported this cost, while subject to great variations, seems to average a good bit less than that entailed by arc lamps of equal aggregate illuminating power.

As to the new incandescents, the actual economy in energy of the tantalum lamp seems to be settled beyond question, and its life under ordinarily good conditions leaves little to be desired. Oddly enough, the only questions raised about its life are those relating to its use on alternating circuits, and these questions have not yet been shown to be anything more than hypothetical. As to the osmium lamp, too, the efficiency question admits of no dispute, and the reports from the zirconium lamp are of a similar tenor. It certainly warms the cockles of the consumer's heart to see, as we did the other day, a tantalum and a carbon lamp burning side by side, the former giving obviously the more light, and yet skimming the meter disc at just two-thirds the rate put up by the latter. And the last word does not seem by any means to have been said on carbon, either, by the sign of the improved lamps just announced. The mercury arc and the vacuum tube, too, are in the game, with somewhat less certain prospects, but surely with a gain in efficiency. We really would like to know as a matter of fact to what extent electric lights

other than enclosed arcs and common incandescents are in commercial use throughout the country. We have a notion that the statistics of the heterodox illuminants would figure up rather surprisingly, The large plants, always rather conservative, are slow in taking up with these newcomers, but the smaller plants here and there and everywhere are beginning to move, some in one direction and some in another. They have not yet been stampeded, as they were by the exploitation of the enclosed arc, but they are perhaps getting ready for a rush. Certain it is that the standard incandescent and the "standard" enclosed arc are to-day up against a very real even if somewhat scattered competition. The new lights are now past the stage that can fairly be called experimental in any proper sense of that much abused word. They are out for business on the good old plan of every one for himself and Devil take the hindmost. May they have a merry chase and let the best light win!

THE TESTING OF ALTERNATORS UNDER FULL-LOAD CONDITIONS.

The Hopkinson method of testing electrical machinery by the circulation of power between a pair of units in such a way that only the wasted power has to be supplied to the system from an external source, has had a number of useful applications. Not only direct-current machines, but also alternating-current generators, motors and transformers are conveniently tested in this way. While, however, there is no difficulty in circulating power between two large transformers even if they are in different parts of the same building, there is often much difficulty in circulating power between two large alternators, owing to the inconvenience of bringing them into mechanical connection. It seldom happens, moreover, that two similar large alternators are available for testing at the same time, and consequently the method of circulating power between two units is not readily applied to large alternators. This has rendered it necessary to break a single large alternator up, electrically, into a pair of divisional units, and to circulate power between these units. At the present time large alternators are almost invariably tested in this manner at the factory, where the armatures are operated on short circuit.

In carrying out the plan, however, various difficulties present themselves in detail, and various methods of connection are in vogue. The Mordey method consists essentially in subdividing the armature into two unequal opposed parts and exciting the fields up to the point at which the residual preponderance of armature coils causes the full-load current to circulate through the whole. The plan involves the existence of unbalanced stresses in the armature; but in certain types of alternator this gives rise to no difficulty. In other types, however, the unbalanced stresses on the shaft of the rotor are found to produce serious vibrations and distortional strains. An alternative plan, suggested by Behrend, is to subdivide the fields into two halves, and excite one half stronger than the other, over the short-circuited armature. In this method the center of the field circuit is grounded in the case of a revolving-field machine. It usually requires only a relatively small difference in excitation between the field halves and greatly reduces the mechanical stresses exerted upon the armatures. In an article recently published in *The Electrician*, Prof. Stanley P. Smith gives some observations made with this and other methods of circulating power in a particular 2-kilovolt, 30-kilowatt, single-phase machine.

In this relatively small machine it was found that the difference in excitation between the two half fields of the Behrend test was so great that one of the half fields was practically without excitation. The stresses upon the rotor shaft were thus nearly as great as though the two half fields had been fully excited in opposite directions. The vibration of the rotor shaft was, therefore, so great that the full-load current could not be circulated through the armature. The impedance of the armature is not stated, but it seems possible that it was sufficiently large in reactance to require much greater differential excitation in the field halves than is required in the ordinary large sizes of alternator. In order to avoid this large vibration a number of different methods of connecting the field coils in opposition were experimented upon. In some tests the field was divided into two groups; in others into three; in yet others into four, and in one case into six, the total number of field coils being twelve. The groups were, moreover, connected up in different ways with regard to symmetry, and also with regard to strength of excitation. In general the results recorded show that in cases where the electromagnetic stresses were balanced, so that the resultant electromagnetic forces acting on the rotor at rest being zero, the power and armature current could be circulated without difficulty up to overload capacities. When, on the contrary, the electromagnetic stresses upon the armature at rest remained unbalanced, as for instance with eight consecutive field coils in one group opposed to the four consecutive coils in the other, the mechanical result was dangerous when the machine was driven at speed. In a few cases, however, the mechanical disturbance at speed was large even when the stresses on the armature at rest appear to have been balanced. In these instances it would seem that the vibration must have been due to unbalanced thrusts set up by armature reaction; i. e., by armature-current magnetization at speed. It would be interesting to ascertain whether the interruption of the armature circuit in these instances would convert the vibratory running into smooth running.

The deductions made in the article, from the observations, point to symmetrical distribution of the generator and motor thrusts upon the rotor shaft at rest, in order to secure smooth running. These deductions are, however, only made upon the observations with this small generator, and it is quite possible that with large alternators the result to be obtained would be markedly different. A great question in all such cases of unusual field and armature connections, not answered in the article but postponed for future consideration, is whether the hysteretic losses in the rotor and stator are substantially the same as in the normal mode of operation. Manifestly, the value of the test would be greatly impaired, or even altogether destroyed, if the circulation of full-load current in the armature could only be secured at the expense of large variation from the normal distribution of hysteresis losses. This is a matter which can only be settled by thorough experimental investigation. It cannot be taken for granted. So troublesome is it in many cases to find the best arrangement of circulating power in an alternator that the method is often abandoned and hysteretic waste is substituted for joulean waste—that is, iron losses for copper losses. This is done by measuring the hysteretic loss on open armature circuit for a large range of voltages and field excitations. The field is then left over-excited at such a strength that the hysteretic loss in the machine is equal to the normal full-load hysteretic loss plus the computed full-load copper loss. It is true that all the wasted energy is thus expended in the iron, instead of being expended partly in the iron and partly in the copper; but in the course of a few hours the equalization of temperature is fairly complete and the gradients of temperature in a large alternator armature are sensibly the same in either case. Another advantage of this test is that the field connections remain normal, while the over-excitation, while it naturally raises the temperature of the field to some extent, yet tends in the direction of safety—that is, to make the machine hotter than it would be in practical operation under full load.

Applause by "Wireless."

A novel application of the wireless telegraph transmitter was made the other night during one of the weekly band concerts given at the Pensacola Navy Yard. The large wireless transmitter station is located near the band stand, and at the finish of a selection by the Navy Band, the De Forest operators, who had been testing their wireless plant, by way of expressing their enthusiastic applause, opened wide the great spark-gap as well as the doors to the sound-proof "spark muffler," and then depressing the Morse key sent out a succession of long, loud dashes, the deafening sound of which could be heard for blocks around. The spark is one of "low frequency," and its rattle, following upon the last notes of the music, sounded not unlike the outburst of thunderous applause from a vast multitude of clapping hands, only sevenfold louder than any ever heard before. The startled bandmaster, recognizing the novelty of this sort of applause, and impressed with the electrical enthusiasm of this new "claque," responded with the only encore of the evening, to the great amusement of the wireless men and his audience in general.

But the most striking part of the whole proceeding came to light shortly afterwards, when the DeForest operator at the station at New Orleans reported that precisely at that time he heard the succession of long, loud dashes, breaking up into the irregular clatter simulating the clapping of hands. So it proves that the bandmaster of the Navy Yard Band of Pensacola has been honored by the most thunderous applause ever yet given in the history of music—applause heard 180 miles! Unfortunately the New Orleans operator was unable to hear the music prompting this etheric enthusiasm.

Private Convention at Hartford, Conn.

According to advices from Hartford, Conn., representatives of thirty gas and electric companies, from cities in various sections of New England, and as far West as Kansas City, were in that city on August 16, attending the annual meeting of the United Gas & Electric Co. The visitors represent companies which are affiliated under the United Gas & Electric Co.

The members of the party were nearly all superintendents of their companies. They were cordially received by General Manager R. E. Slade, of the Hartford City Gas Light Company. After a thorough inspection of the company's works, they went to New Haven to inspect the new plant of the New Haven Gas Light Company, and returned to Hartford for their first business session at the gas works this morning. During the meeting the subject of high pressure lines was taken up. A committee will report on the subject of "Ammonia." After lunch the session was resumed, and at 5 P. M. the party visited the new and partially completed plant of the Hartford Electric Light Company at Dutch Point. On Wednesday the report of the committee on electric signs was read. Topics relating to advertising were also taken up and discussed. The subject of gas engines was also taken up. The visitors then left for Albany and on the following day they were guests of the General Electric Company, a private car conveying them to the works at Schenectady.

Underground Conduit for Long Distance Telephone.

Details of construction of a projected underground conduit for telephone service between New York and New Haven have been announced from the New Haven office of the Southern New England Telephone Company. It is a joint undertaking entailing a large expenditure of money and is being financed by the Southern New England and the American Telegraph & Telephone Company. All surveys and draughtings have been completed and contractors are now bidding on the work.

The present conduit extends from New York to Portchester and the work from there will be begun in the early fall. It will be of great use in the toll line service, for which it is expressly designed. In building this conduit a trench four feet deep is made with a cement flooring or foundation. Upon this the ducts are placed. The number varies from six to eight in the country sections of the line, but as cities are approached the number greatly increases. A layer of planking preserved by creosote protects the tiles from damage by promiscuous digging along the line.

The cables themselves are not fastened inside the tile piping, but may be drawn out and replaced in case of necessity by a system of manholes which will be built every thousand feet.

Porcelain Electrical Supplies.

Statistics of the clay-working industries in the United States, which have been compiled by Jefferson Middleton, show that, of the total pottery produced in 1904, 5.69 per cent., representing a value of $1,432,943, was used for porcelain electrical supplies. In the year 1903 there were 31 producers of such supplies, while in 1904 the producers had increased in number to 33. It is interesting to observe that the greatest centers of the pottery industry are found at Trenton, N. J., and at East Liverpool, O. At the former place during the year 1904 the porcelain electrical supplies produced had a total value of $276,714, and at the latter place the corresponding value was $371,802, or the total value for the two places was $648,516, which represents more than 45 per cent. of the whole supply of the United States for last year. Probably there were some porcelain supplies of an electrical character not specifically reported as such.

Defining the Ether.

Mr. W. A. Shenstone, F.R.S., in a recent magazine article says: Of all the theories of the ether, that propounded by Professor Osborne Reynolds is perhaps the most startling. It inverts all our previous ideas on the subject. According to this, the youngest theory of the ether, we must look upon the ether as the one really substantial thing in the universe, its density being ten thousand times greater than that of water; while matter, which seems so substantial, consists, so to speak, in an absence of mass, and has the character of a mere wave in the ether. On this newest view "we are all waves," as the author of the theory, bursting into poetry, exclaimed at the close of the eighth section of his Rede lecture. This astonishing proposition, which has cost its author no less than twenty years of labor, asks us to imagine that the universe, except those minor portions which constitute matter, is built up, like a bag of sand, of grains of definite shape and in size so inconceivably small that their diameters are no greater than the seven hundred thousand millionth part of the wave-length of violet light, which in its turn amounts to only sixteen millionths of an inch, and so closely packed that, though not absolutely immovable, the four hundred thousand millionth of the seven hundred thousand millionth of one sixty thousandth part of an inch—i. e., the four hundred thousand millionth part of their own diameter—would represent approximately the mean free path through which these particles are free to move. Professor Reynolds tells us that the density of this medium, far from being almost indefinitely small, is nearly five hundred times as great as that of the densest matter known to us on earth, and its pressure more than three thousand times greater than that which any material yet tried has been known to sustain.

To get some idea of this conception of the ether, picture to yourself a billiard table carefully packed from one end to the other with line after line of billiard balls, each line so nicely fitted or geared into the next that the balls are packed almost as close to each other as is possible, yet not so very tightly as to prevent, absolutely, all motion among them. Imagine, again, that you have not one layer of balls, as on a billiard table, confined by the sides of the table, but layer upon layer piled one above the other and extending absolutely without limit in every direction. Remember that these balls or grains are so minute that, say, 11,200,000,000,000,000,000 of them laid side by side along a line would only occupy a single inch, and you will have a picture, so far as may be, of Professor Reynolds's conception of the universal medium, the ether.

Transformers for the New York Central.

The order for transformers to be used in the electrical operation of the New York Central & Hudson River Railroad at its New York terminal has been awarded to the General Electric Company. It covers all the transformers to be used in the eight sub-stations of the electric traction district. There will be fifty-four 375-kw and eighteen 550-kw transformers for operating rotary converters, and thirty-three 120-kw transformers for operating booster sets. All these transformers are of the air-blast type, and are built for 25-cycle circuits. This represents a total of 34,100 kw, or, approximately, 45,000 hp of transformer capacity. The sub-stations which will contain this apparatus are located at various points throughout the New York district, extending from the Grand Central Station to Croton-on-Hudson, on the Hudson River Division, a distance of thirty-four miles, and to North White Plains, on the Harlem Division, twenty-four miles. Three-phase, alternating current generated by Curtis turbines at 11,000 volts, will be transmitted from two power houses, one at Glenwood-on-Hudson, a suburb of Yonkers, and the other at the end of the Port Morris branch on Long Island Sound. At the sub-stations the alternating current will pass through these transformers and by means of rotary converters will be transmitted to the line at 600 volts direct current.

On account of the extraordinarily heavy service to which these transformers will be subjected, a brief description of the general design employed may be of interest. The transformer coils, both primary and secondary, are assembled vertically in groups side by side with intermediate air ducts. The groups are subdivided into several flat coils built up of flat conductors of rectangular cross-section, one turn per layer. A continuous non-combustible insulation consisting of mica strip separates each turn from the next, and the completed insulation on the coils can withstand potentials two or three times greater than the same thickness of the best insulating oil. Channels of insulation moulded into proper shapes maintain the requisite spacing and hold the coils firmly in place. The assembled structure is tightly bound together, thus preventing any possibility of vibration of the coils.

The insulation on the primary and secondary coils (which would readily withstand a much higher potential than that for which it is designed), the diaphragms between the primary and secondary coils, and the additional insulation due to the air ducts between the primary and secondary windings, insure a high factor of safety. The sheet-iron core is assembled around and through the coils, the core being supported directly on the cast-iron base. The numerous air ducts between the coils and through the core structure, in connection with motor-driven blowers, provide a circulation of air which maintains a low uniform temperature in all parts of the windings.

The order for the motor-driven blower sets for all of these transformers has also been awarded to the General Electric Company. These transformers are provided with one-third and two-thirds voltage taps on the low-tension side, to permit the starting of the rotary converters directly from the alternating-current end without the use of starting motor or starting compensator.

Statistics of American Railroads.

The annual report of the Inter-State Commerce Commission, giving the railroad statistics for the year 1904, shows that there were at the end of that year 297,073 miles of railroad in the United States operated by 2,104 corporations. The increase in single trackage for the year was 5,927 miles. On June 30, 1904, there were in the service of the railways 46,743 locomotives. The total number of cars of all classes, exclusive of those owned by private companies, was 1,708,561, 39,752 in passenger service and 1,692,184 in freight work. The number of persons on the payrolls of the railways in the United States was 1,296,121, or 611 per 100 miles of line. The wages paid for the year amounted to $817,598,810. The par value of the amount of railway capital outstanding on June 30, 1904, was $13,213,124,670. Of this capital $6,339,899,329 existed as stock, and the remaining part, $6,873,225,350, as funded debt.

Of the total capital stock outstanding $2,696,472,010 paid no dividends. The amount of dividends declared during the year was $221,941,049, equivalent to 6.09 per cent. on dividend-paying stock.

The number of passengers reported as carried by the railways in the year was 715,419,682. The passenger mileage was 21,923,213,536. The number of tons of freight carried was 1,309,899,165. The ton mileage was 174,522,089,577. The gross earnings were $1,975,174,091. Operating expenses were $1,338,896,253.

The total number of casualties to persons on the railways was 94,201, 10,046 killed and 84,155 injured. Of the persons killed 441 were passengers and the wounded 9,111, or one killed out of every 1,622,267 carried, and one injured out of every 78,523 carried.

Telegraphy and Telephony in Great Britain.

The fifty-first annual report of the British Postmaster-General has just been issued. It applies to the year ended March 31, 1905, and contains a variety of interesting data as to telegraphy and telephony in Great Britain. He says:

During the year 88,969,000 telegrams passed over the Post Office wires, as against 89,997,000 in 1903-4, a decrease of 1.14 per cent. The total value, however, has increased, being £2,755,485, as against £2,741,191 last year. The estimated value of the railway free telegrams is £55,800, against £59,100 in 1903-4; that of the Government free telegrams £22,800, against £23,200 in 1903-4. The decrease in the number of ordinary inland telegrams is, perhaps, due partly to trade depression; but, as it is coupled with an increase of 5.1 per cent. in the foreign telegrams, it may be attributed largely to the growth of the telephone system. The number of foreign telegrams is the highest on record. The average number of words per week in press telegrams during the year was 15,531,332, against 14,588,458 in 1903-4. The telegraph offices now open in the United Kingdom number 10,172 at post offices and 2,354 at railway stations and other public places. The system of providing direct communication between provincial towns has been pursued, as in previous years. The system of direct intercommunication between telegraph offices in London, of which the first portion was installed two years ago, continues to give good results; and it will be possible to connect a number of additional offices to the switch before the end of the present year. The underground line from London to the North has been extended by the provision of a cable containing 97 wires between Warrington and Carlisle, and the laying of 76 miles of pipes, which, together with the section laid in the previous year over the Beattock incline, complete the pipe line from Carlisle to Glasgow. It is proposed this year to provide wires over the latter section, and communication will then be possible between London and Glasgow by means of underground wires solely. A pipe is being laid to contain 137 wires between Hanwell and Slough, and during the present year it will be extended from Slough to Reading. The provision of a pipe and cable between London and Chatham is also being considered as a beginning of an underground route to the southeast coast, the point of departure of many of the submarine cables. Experiments with various high-speed automatic typewriting telegraphs are being continued, and some of the systems are very promising. British makers of electric plant are now devoting more of their attention than formerly to the manufacture of telephone apparatus; though it is not possible yet to dispense—or nearly dispense—with the services of foreign makers. Arrangements have been made for the establishment of a second direct wire between London and Cologne, and also for the establishment of direct telegraphic communication between London and St. Malo during the potato and fruit season. The question of further increasing the facilities for communication between London and Paris and certain other Continental towns is receiving attention. No new cables from the United Kingdom have been laid during the year, but it has now been arranged for a cable to be laid between the Shetland Islands and Iceland via the Faroe Islands by the Great Northern Telegraph Co. The strategical importance of wireless telegraphy, and the fact that some centralized control is necessary if the public are to secure the fullest advantage from this new means of communication, led to the passing of the Wireless Telegraph Act of last session (4 Edw. 7. c. 24), which renders it illegal for any person to install or work wireless telegraph apparatus in the United Kingdom, or on board British ships in territorial waters, except with the license of the Postmaster-General. In view of the progressive nature of the invention, and the possibility of unforeseen developments, the act was made operative for a period of two years only, to expire on July 31, 1906. The experience of the working of the act shows that it will be essential

to the public interest that it should be renewed. Some difficulty has been experienced in dealing with the applications for commercial licenses, owing to the fact that, in the present state of electrical science, it is impossible for the stations of rival undertakings to work in the same neighborhood without danger of mutual interference. The International Conference on Wireless Telegraphy, which was to have been held in April last, has been postponed owing to the political situation. The number of telephone trunk-wire centers on March 31st last was 443, an increase of 47 in the year. The new trunk circuits provided during the year numbered 186, and the total number in use was 1,604, as compared with 1,418 in the preceding year. The total length of the trunk circuits in use was 56,400 miles, containing about 112,800 miles of wire. The capital expenditure on the purchase and development of the trunk wire system up to March 31st last was £2.537,288, including an expenditure during the year of £337,264. The total number of conversations over the trunk wires for the year was 15,461,822. This shows an increase of 1,993,847, at the rate of 14.8 per cent., over the corresponding number for the previous year, which was 13,467,975. The gross revenue derived from this service was £380,308, as compared with £325,525 in 1903-4. The increase was thus at the rate 16.8 per cent. The average value of each conversation was 5s. 9d. There are now four telephone circuits between London and Paris, one between London and Lille, and two between London and Brussels, the latter carrying an increasing amount of traffic. A still further development of these services may be expected since the agreement with the National Telephone Co. has been approved by Parliament, as under that agreement the lines will become available for use by subscribers to the company's system. Experiments have recently been made in telephonic communication between London and Rome by way of Paris. It was found possible to exchange speech when the conditions were exceptionally favorable; but, in spite of the partial success of the experiment, a public service between the two capitals is not at present practicable. The total number of subscribers to the Post Office provincial telephone exchanges on March 31st was 6,854, and the number of telephones rented increased in the year from 6,874 to 8,644. According to returns recently furnished by the Corporations concerned, the number of telephones connected with the exchanges of the various municipal systems in Great Britain, were as follows:—Brighton, 1,736; Glasgow, 11,923; Hull, 1,495; Portsmouth, 2,250; Swansea, 1,259. The number of telephones in connection with the Post Office London telephone system increased during the year from 15,632 to 24,351; and additional subscribers are being connected at an average rate of about 150 a week. A new exchange was opened at Hampstead during the year under review, and two others have been opened since March 31st. The accommodation at the central exchange is now almost exhausted, but a new exchange, to be called the City Exchange, with a maximum capacity of 18,000 lines, is expected to be ready for opening in a few months. The length of the underground pipes which had been laid in the London area on March 31st last was 1,251 miles, 105 miles having been laid during the year. Cables containing 162,216 miles of wire have been provided, including 35,572 miles rented by the National Telephone Co. pending the transfer of the company's system to the Post Office. The lines of the present subscribers and the junction lines between exchanges have absorbed 66,821 miles; and 59,823 miles of wire remain available for the future development of the London telephone system. The average cost of construction per mile of double wire has decreased since last year from £18 16s. 10d. to £16 18s. 6d.; and the average cost of constructing an exchange circuit (including the installation of telephone instruments and of exchange apparatus, but excluding the provision of spare plant) has been £38 18s. 9d., as against £41 9s. 8d. in the previous year. Taking into account the whole system, including spare plant of all kinds, the capital expenditure per station (i. e., per telephone connected with an exchange) stands now at £64, as compared with £86 in 1902-3 and £73 in 1903-4. It is hoped that the expenditure per station will still further diminish as the very large amount of spare plant provided comes into use. An account of the receipts and expenditure relating to the London service for the year ended March 31, 1905, is printed in an appendix. It shows a balance of £93,298, a sum nearly sufficient to meet the charge for interest on capital and to provide for depreciation of plant. This balance is rapidly increasing as more of the plant comes into use and begins to earn revenue. Similar tables are also given (for the first time) in respect of the Post Office provincial exchange systems and the trunk-line system. A table is also added to show the financial position of the three systems taken as a whole. This shows a balance of £282,321, while the estimated amount required to provide for depreciation of plant and interest at 3 per cent. on the capital expenditure of £5,042,000 is £300,776. The amount of royalty received during the year from the National Telephone Co. was £192,562, and from other licenses £8,163. Two million five hundred and thirty-seven thousand five hundred and fifty telegrams and 48,900 express letters were sent by telephone for onward transmission, and efforts are being made to bring the advantages of these services more clearly under the notice of telephone subscribers.

The Exhaustion of the World's Supply of Iron and Copper.

A recent issue of the *International Quarterly* contains an interesting article by Prof. N. S. Shaler, in which he discusses the importance to civilization of the metals, iron and copper, and deals with the possibility of the world's supply being exhausted. If any of the important metals, except iron and copper, were by some accident, to be transmuted, it would cause a temporary inconvenience, but the world would soon adjust itself to the loss. With copper, and in a greater degree with iron, however, it is far otherwise. Our whole civilization, indeed, may be said to be built on iron. Its cheapness forms a considerable element of its value to man. Iron is a very widely distributed element, and the amount of iron ores still available is very great, perhaps twenty times as great as has been won to use. Some of the best-known fields, however, are beginning to be exhausted, and it is evident that at the present rate of consumption of iron, the European source of supply are not likely to endure for a century. It may fairly be assumed that beyond the present century, the world as a whole will not have access to the metal at anything like the present cost in terms of labor. It is not to be supposed that the iron age will suddenly pass away. The cost of production will gradually increase as the lower grade ores and those remote from coal come into use. Later we shall have to resort to concentrating processes to separate the iron ore from the rock in which it is disseminated as grains. Finally, it may be some centuries hence, but surely, the world will be forced to an economy in the use of the metal such as was exercised 200 years ago. There exists a considerable leeway in the case of iron in the saving that will be made in scrap materials as soon as the price rises to, say, $50 per ton.

In the case of copper, the sources of supply are very much rarer than those of iron, and the total amount of the metal in the crust of the earth is probably not more than the thousandth part of that of iron. Its supply will doubtless be reduced to a point where its service to the arts will be seriously limited before there is a like reduction in the supply of iron. We can, however, look upon the approaching exhaustion of the sources of copper with less apprehension than in the case of iron, for the reason that, useful as the metal is in manifold ways, it is not indispensable, or even very necessary, in our arts except in the transmission of electric power, and, even in that, substitution is possible. In its qualities aluminum is admirably adapted to serve most of the needs now served by iron and copper. It is relatively very light, but for its weight is admirably strong, rigid, tough and elastic; it is a good conductor of electricity and it does not oxidize as readily as do iron and copper. The amount of aluminum lying almost at the surface of the earth's crust is enormous, probably many thousands of times as great as the amount of iron contained in the concentrated form of beds or veins. Every clay bank is a possible source of the metal. Aluminum is never found in the metallic state, but in the form of silicates. Before it can be put to the uses of man, its union with the silicon must be broken up, and the work of separating the elements is very costly. With any methods now conceivable we have to reckon that, while aluminum is likely in time to take the dominant place now held by iron, it will do so at a cost in terms of labor far higher than what men now pay for their capital metal. Nevertheless, the difference is not likely to be so great as to prevent aluminum from coming to the rescue of the mechanical foundations of our economic civilization.

The Old-Time Telegraphers' Convention.

The Old-Time Telegraphers' and Historical Association and the Society of the United States Military Telegraph Corps will hold their annual conventions in New York City separately and together next week, the exercises beginning on Tuesday and continuing until Friday inclusive. It is ten years since the two bodies last met in the metropolis, in which time a great many changes have been seen, not only in the personnel of these two organizations, but in the surrounding conditions that relate to telegraphic work. The Old-Time Telegraphers are fortunate in having at this juncture as president Mr. John C. Barclay, the efficient and energetic general manager of the Western Union Telegraph Company, and Mr. Francis W. Jones, chief electrician of the Postal Telegraph-Cable Company, as vice-president. The president of the Military Telegraphers is Col. W. B. Wilson, of Philadelphia. Behind these gentlemen stand a very able body of executive officers and a large number of working committees, of prominent men and their wives, the largest of which are those of reception and the ladies' general committee.

At the head of the reception committee is Mr. T. L. Cuyler, Jr. Mrs. F. W. Jones directs the work of the ladies' committee. The headquarters will be at the Waldorf-Astoria. On Tuesday, August 29, the business meetings will be held of both bodies in succession, with entertainment in the afternoon, and a theatre party in the evening. This is the only day in which any real work will be attempted, as the underlying object of both societies is not technical but the renewal and maintenance of friendships formed in the earlier days of the art. The Old-Time Telegraphers has become in a sense a self-perpetuating body, but it is needless to say that the ranks of the Military Telegraphers, constituted as it is of men who took part in the Civil War, are becoming thin, and that of the large body of operators who risked their lives at the front a bare handful is now left. The programme on Wednesday includes a trip to Coney Island, while on Thursday the banquet will take place at the Waldorf-Astoria, when Mr. Barclay expects that at least 500 to 700 will participate. Friday will be devoted to automobile rides and then the convention will disperse.

The Electrical Industries of Germany.

Mr. F. Oppenheimer, consul general from England to Germany, in the course of a report on the electrical industries of the German empire, says: "1904 has been called the year of resuscitation for the electrical industry in Germany. During the three preceding years the electrical industry had suffered very considerably because it had unduly extended its operations, as the result of which there was considerable overproduction and a very noticeable drop in prices. The electrical industry had, however, not been idle during the slump, but had endeavored to achieve practical successes through the perfection of its technical achievements and through intensified endeavors to apply profitable methods of production. As the result of this the turn of the tide last year found the industry well prepared, and its production reached the largest figures ever known.

"The perfecting of steam turbines during recent years assisted the extended use of electricity, as did also the more general manufacture of tools and tool machinery driven by electric power. In many instances public and municipal authorities and the larger electrical companies have endeavored to bring the advantages of electrical motors within the reach of the smallest industries by direct or indirect subsidies. Agriculture, too, is considerably extending its use of productions of the electrical industry in view of the prevailing scarcity of agricultural labor. Lastly, modern traffic in its various branches is availing itself of the advantages of electricity for technical improvements and by conversion of various other methods of locomotion to electricity.

"The electrical industry enjoys this advantage over other industries, that in spite of the existence of a few gigantic electrical concerns there will always be room for smaller factories manufacturing specialties, to which some of them owe a world-wide reputation. The special factories, of which there are approximately 225, occupy about 43,000 hands, representing 60 per cent of all hands employed in the German electro-technical industries. The total number employed in Germany today amounts to approximately 72,500, against 26,321 in 1895 and 54,417 in 1898. The working capital engaged in the electro-technical industry in Germany at the end of 1904 was estimated to amount to 600,000,000 m., of which 500,000,000 m. were represented by 35 limited liability companies, and the remaining 100,000,000 m. by all other firms.

"The financial result, in spite of the outward expansion, was not as satisfactory as might be expected. The reductions in the prices for finished articles, which were due to the years of the slump, have not yet been made good. Though an improving demand fosters higher prices, it was counterbalanced by a considerable increase in the number of producers. At the same time production has increased owing to improvements of manufacture, but this possibility of increased production has not resulted in any financial gain, because at the same time the most important raw materials of the electrical industry have risen considerably in price. Increased production and the increased price of raw materials have in other industries suggested syndication as a remedy. Any such syndication at present, however, still appears impossible in the electrical industry on account of the great variety of finished articles, though possibly the amalgamations which have taken place are preparing the way.

"The import of electrical machines amounted in the year 1900 to 4,350 met. centners, in 1903 to 10,094 met. centners, and has risen during the last year to 14,777 met. centners. The imports of accumulators, of wires insulated with india rubber, of low-current apparatus, of cables and electrode carbons, have always been inconsiderable, but the import of glow lamps has risen from 935 met. centners in 1901 to 1,336 met. centners in 1904, an increase which is due to French competition. The same cause has also increased the import of carbons, which in 1901 amounted to 452 met. centners and to 2,349 met. centners in 1904. The export of electrical machines amounted in 1900 to 129,178, in 1903 to 135,755 and in 1904 to 134,914 met. centners. The export of accumulators has risen from 16,079 met. centners in 1901 to 29,801 in 1904; of carbons from 12,429 met. centners in 1901 to 31,248; of electrode-carbons from 2,396 to 27,565 met. centners; of low-current apparatus from 4,283 to 6,367 met. centners. The export of cables amounted in 1904 to 209,634 met. centners and shows no actual improvement over the figures for 1900 (154,410 met. centners), as the former figure includes the export of submarine telegraph cables for the first time, and this in 1904 amounted to 58,950 met. centners. The world's market was particularly bad for wires insulated with india rubber, of which only 1,479 met. centners were consumed, against 7,000 met. centners in 1901. There is no doubt that, generally speaking, the difficulties in the sale abroad of the products of the German electro-technical industries are constantly increasing."

Extensive Trolley System Around the Great Lakes.

An important step has been taken with regard to unifying the control of the trolley systems that may be said to have Buffalo as a center. A new corporation, called the Tractional Company, has been formed to take over the entire stock of the International Traction Company, which owns the street railway lines of Buffalo. The total length of all the lines combined is about 375 miles. One share of the new company's stock will be exchanged for 100 shares of International Traction Company's common stock.

The capital stock of the Tractional Company amounts to $100,000, only $76,000 of which is to be issued immediately; the International Traction Company is capitalized at $15,000,000. Henry J. Pierce, president of the International Traction Company, is also president of the new corporation. The directors are Thomas De Witt Cuyler, G. L. Boissevain, Nelson Robinson, Grant B. Schley and Henry J. Pierce. Arthur Robinson is secretary and treasurer. The Tractional Company was incorporated under the laws of New Jersey.

Among the properties owned by the International Traction Company are the Buffalo Railway Company, the Buffalo, Tonawanda & Niagara Falls Electric Railroad, the Niagara Falls, Whirlpool & Northern Railway, and the Queenstown Heights Bridge Company. There are eleven other railroad companies in the list.

The banking firm of Kean, Van Cortlandt & Co., which has a very large interest in the new concern, controls the traction lines of Detroit and the traction lines and lighting companies of Toledo, and

is the syndicate manager of the car builders' combination, which embraces nineteen of the largest car builders of the country.

The International Traction Company was formerly controlled by J. P. Morgan & Co., and was sold by them last March. It was announced at that time that certain Buffalo and Philadelphia capitalists had purchased the road, but the fact that Kean, Van Cortlandt & Co. is backing the new control has only developed with the formation of the Tractional Company.

The possible extent of the activities of the group of capitalists which has organized the Tractional Company was outlined this week by one of the parties in interest. At the present time trolley lines are being built from Rochester to Buffalo and from Buffalo to Cleveland. Lines already are in operation from Cleveland to Toledo and from Toledo to Detroit. The New York Central is supposed to have an interest in the Rochester-Buffalo line, but the other lines are independent.

CURRENT NEWS AND NOTES.

TELEGRAPHY IN ALASKA.—The entire receipts of the Government telegraph and cable lines in Alaska will be used toward the extension of telegraphic communication in the north each year, according to an agreement reached between Gen. A. W. Greely, head of the U. S. Signal Service Corps, Congressman Humphrey and others.

WIRELESS IN MEXICO.—It is designed to establish wireless telegraphy in various parts of Mexico, using the Marconi system. Camilo Gonzalez, who is general manager of the Mexican Federal Telegraph Company, will have charge of the installation. The first system will probably be installed in the State of Chihuahua, while other stations will be erected in Jalisco, Tepic, Sonora, Sinaloa and Nuevo Leon.

TELEPHONING THE DOCTOR.—Walter Messersmith, Muncie, Ind., accidentally cut an artery a few days ago. A physician was telephoned, and, five minutes after receiving the message, was speeding to the Messersmith home in the fastest automobile obtainable. The young man is recovering. The family say the young man would have died from loss of blood had there not been a telephone in the house.

TROLLEY-STEAM COMPETITION.—The New York Central Railroad, with the permission of the State Railroad Commission, has decided to close its station at Crane's Village, a small place on the main line near Amsterdam. The passengers formerly using that station, at which six trains stopped daily, have been traveling on the trolley line passing through the village instead of on the railroad, and the steam patronage was literally wiped out.

TELEGRAPHERS' STRIKE OVER.—The strike of telegraphers on the Great Northern Railroad is at an end. The telegraphers who went out August 1 are asking reinstatement. President Perham, of the Telegraphers' Union, ordered a vote on the proposition to end the strike and return to work when he found he could not hold the men in line or force the railroad to terms; and the whole thing is now over, except for the unfortunates out of a job.

TRAIN TICKER SERVICE by means of wireless has been discussed and some years ago was attempted by the train telegraph static systems then on trial. There are other ways of accomplishing this and it is now reported that financial patrons of the Delaware, Lackawanna & Western Railroad will in future not have to await their journey's end to secure information in regard to the stock market. The railroad has arranged to supply passengers on its fast trains during market hours with the latest quotations from the New York Stock Exchange. The quotations will be distributed to the passengers on the arrival of each of the fast trains at Scranton on the trip either east or west.

SWISS ELECTRIC ROADS.—New electric roads are to be built in Switzerland as follows: Lugano to Paradiso, Lugano to Gerra, Lugano to Salvatore Railroad Station, Molino Nuovo to connect with St. Gotthard Railroad, Meyringen to Grindelwald, Oerlikon to Schwamendingen, Locarno to Valmara, Locarno to Camedo, Grindelwald to the Sea of Ice. Switzerland has a great electric scheme in view—the conversion of all its State railways to electric traction. They cover 1,520 miles of route, 242 being of double track, nearly all of which can be operated electrically. The Confederation makes money by its railways, the receipts last year being $23,680,000 and the expenses $15,600,000, and the government expects to make more (or to reduce fares) with electric traction. The Swiss lines are among the cheapest and best to travel on in Europe.

SUBMARINE-BELL SIGNALS.—The United States *Daily Consular and Trade Reports* for July 26 contained a statement from Consul-General Holloway, of Halifax, quoted in these columns, to the effect that the St. Lawrence River was not to have the benefit of submarine-bell signals, for which a contract has been made by the Dominion Government. This statement was made on the authority of a leading Canadian trade journal. Consul-General Holloway now reports that the Submarine Signal Company denies the accuracy of that statement, and declares that the bells, for which a contract has been made with the company by the Canadian Government, will be installed in due time, large shipments of material having already been made and the work being well under way. The company is required to equip with its apparatus 30 steamers. These need not necessarily be Canadian vessels.

THE CONFERENCE AND CABLES.—We noted recently the elaborate preparations made at Portsmouth, N. H., for handling the peace conference work. It is stated that the Postal and Western Union Telegraph Companies have been using 35 wires from the Wentworth Hotel and 50 operators, handling 50,000 words of press matter daily, exclusive of cables. The press cable rate to Tokio is 53 cents per word and to St. Petersburg 28 cents per word—14 letters or figures are counted as one word. The Russian cables go via French cables to Havre then to St, Petersburg direct; the Japanese cables via San Francisco, Honolulu, Guam and Manila. The rates charged for private cables are: St. Petersburg, 43 cents per word; Tokio, 133 cents per word. The envoys' cables exchanged with their respective governments often number 400 words. St. Petersburg time is seven hours ahead of Portsmouth; Tokio, 14 hours ahead. The Western Union has done the most press business, but the Postal Telegraph Company has had a lion's share of the cable business. Both the Russians and the Japanese have private wires to the Postal Telegraph Cable office on the ground floor of the hotel and summon an operator whenever they wish to send a message. Most of the dispatches are simply code words thrown into figures. A very liberal use has also been made of the long-distance telephone.

NURSING EXPORT TRADE.—United States Special Agent Hutchinson has been discussing export trade to Brazil in a series of very interesting letters. In one he says: "Much complaint is made as to the spasmodic character of American enterprise in the Brazilian market. A dull year in the domestic markets of the United States sends a flood of circulars and a horde of commercial travelers to South America in an attempt to get rid of surplus product. Usually these efforts are fairly successful, merchants here being induced by the excellence of the goods or by unusually low prices to enter into American connections. But the moment the home market shows improvement the American exporter grows indifferent and neglects or postpones attention to his South American orders. In short, Brazil is looked upon as a convenient dumping ground in times of need while the demands of more regular trade are neglected. This complaint I find is quite as universal as the one concerning careless packing. And in some cases the neglect takes the most exasperating forms. For instance, I was told a few days ago by one of the largest importers of goods from the United States, a man who fully recognizes the excellence of American manufactures and the possibilities of development of our trade, and who is anxious to do a larger business with us, that he has almost despaired of increasing his American purchases or dealing with any but a few of the largest and best-known American firms. He told me of numerous cases in which, after forming new American connections solicited by the Americans themselves, he had had his orders neglected, or his shipments delayed, for months or even abandoned entirely, with no more satisfactory excuse (to him) than that the factory was 'too busy' on other orders. Such connections he naturally abandons at once and for good."

NICARAGUAN DEVELOPMENT.—The Nicaraguan Finance & Improvement Company has secured a concession from the government permitting it to utilize the waterfalls of the Tipitapa River for hydro-electric development, and is also to build a railroad from Managna to Jinotega.

CABLE STEAMER ASHORE.—The cable steamer *Colonia* ran ashore last week on the Nova Scotian coast. A cable dispatch from Canso of August 19 says: "There was no change during this forenoon in the position of the British cable steamer *Colonia,* which grounded yesterday on the rocks near Fox Island, off this port. The steamer *Mackay-Bennett* stood by to-day ready to make an attempt to float the stranded vessel at high tide. The *Mackay-Bennett* is taking off the cable and apparatus to lighten the *Colonia.*" The cable steamer is engaged in laying the new Atlantic Commercial cable.

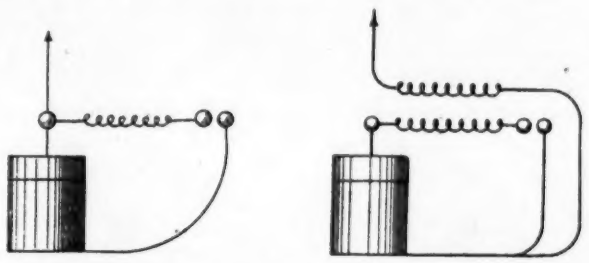
FIRE HAZARDS.—In its *Quarterly Bulletin,* recently issued, the National Fire Protection Association gives a report of the committee on special hazards and fire records. The bulletin contains three instructive articles dealing with shoe factories, paper mills and candle factories, respectively, which describe the various processes involved and point out the fire hazards in the different departments of the factories. Of the 71 pages of the bulletin, 12 are devoted to special hazard fire record and 25 to sprinkler fire record. The cause and result of each fire reported are treated in detail, and numerous illustrations are given of sprinkler fires.

WIRELESS DISTANT ACTION.—An item is copied by American newspapers from the London *Telegraph* as follows: "M. Branly, one of the foremost of French experimenters in wireless telegraphy, describes apparatus by which mechanical effects at a distance may be produced by etheric waves—such as starting a motor, lighting a lamp, or causing an explosion. It requires only suitable instruments at the distant station to bring about these effects, without any human assistance. The idea is not new, though the apparatus is. M. Orloff has shown in this country how a boat or torpedo may be steered by an electrician on shore." All this is very old in America. Mr. Tesla long ago exhibited a wireless automaton floating fort or gunboat, and at the New York Electrical Exhibition of 1898 miniature men-of-war were blown up in a tank by little floating mines discharged from the gallery by "wireless."

GREAT UNDERGROUND TERMINAL.—Plans for the Manhattan terminal of the Williamsburg Bridge have been drawn up by the New York Bridge Department. The Manhattan terminal will be entirely underground. It will be 600 ft. long and about 180 ft. wide, and will have altogether about 120,000 sq. ft. It will be about only one-third the size of the Manhattan terminal of the Brooklyn Bridge, but every inch will be adapted to transportation purposes. It will have a greater capacity for trolley lines, but probably only one-half that for elevated lines which the Brooklyn Bridge terminal has. The Williamsburg terminal will have eight loops for trolley lines. These will be entirely for the use of the Brooklyn Rapid Transit Company. The cars of the New York City Railway will require no terminal in Manhattan. There will be four subway tracks in the terminal. At least $1,000,000 will be spent on the work.

SPANISH ELECTRICAL WORK.—The municipality of La Rambla and the municipality of Calannas (province Huelva) plan the installation of electric lighting. Don José Lopez Planas in Oviedo has obtained a permit for constructing an electric tramway between Oviedo and Posada. The town of Orense is to get a telephone system. Talavera de la Reina (province Toledo) is also to have a telephone system. The town of Mazarron projects the construction of electric works for lighting. The ministerio de la gobernacion in Madrid has been empowered to spend $58,000 for repairing submarine cables. A trolley line will be built from Valencia to Moncada. A syndicate has applied for a concession to utilize the water power of the Henares and the Tajuna Rivers for creating electric energy to supply light. Don Felipe Mora, Armunna (Guadalajara), is interested in the project. The Dirección General de Obras Públicas in Madrid has granted a concession to the Sociedad La Plata for utilizing the Bornoba River in Hiendelaencina in the province of Guadalajara for the development of electric energy to work the mines of that district. Don José Lopez Planas, of Oviedo, has a franchise for an electric road from that city to Posada.

SPACE TELEGRAPHY.—On August 15 two patents were issued to Ferdinand Braun relating to wireless telegraphy, the applications being filed February 6, 1899. The inventor proposes to use waves of great length in order to prevent the absorption of the waves by



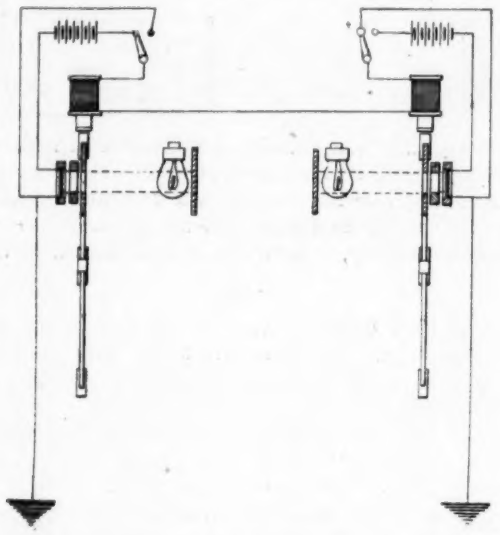
objects in the path of transmission, and states that such waves can be produced by the discharge of Leyden jars of the usual size in a circuit having moderate inductance. The transmitting wire may be connected conductively to the oscillation circuit or the connection may be made inductively, as indicated in the illustrations herewith.

CONTROLLER FOR ALTERNATING-CURRENT MOTORS.—In the operation of controllers which are employed for varying the active lengths of the windings of transformers from which the motors are supplied with energy, either the motor circuits are broken at each step or portions of the main transformer windings are temporarily short-circuited, and arcs are produced when either of these changes takes place. Two patents granted August 15 to R. P. Jackson relate to means for reducing the arcing to such an extent that it does not seriously affect the operation of the controllers. The inventor employs an auxiliary inductance coil which is normally shunted across adjacent taps on the variable-potential transformer, and to the middle point of which is connected one terminal of the motor circuits. When the connections are made as here indicated, very little current flows in the local circuit of the coil, due to its high inductance for such current, but the requisite amount of current reaches the motor, because this latter current divides in such a way that the resultant magnetomotive force due thereto is zero and the inductance is nil. The inductance coil is transferred from one pair of taps to the next adjacent pair without being completely disconnected from all taps simultaneously. It is stated that comparatively little sparking occurs when this operation takes place, since one portion of the winding of the inductance coil is amply able to carry the motor current and the voltage of the circuit broken is comparatively low.

STEEL BY ELECTRICITY.—In a communication to the London *Times* Mr. F. W. Harbourd says: "While, on the one hand, the extravagant claims urged on behalf of electric smelting—that it will revolutionize the manufacture of structural steels as at present made by the Bessemer and open-hearth processes—may be dismissed as nonsense, the attempts on the other hand to prove that it cannot compete with the crucible process in the manufacture of tool steels, or the open-hearth furnace for many of the higher class steels intermediate between these and common structural steel, may equally be disregarded. The truth lies between these two extremes; and the manufacturer who realizes this and takes advantage of the great possibilities which the electric furnace offers to meet very many of the special steel requirements of to-day, and who does so with judgment and knowledge, will, without doubt, be in a most exceptional position, not only to meet foreign competition, but to more than hold his own against his British competitors. Since the Canadian Commission visited Europe last year, rather more than a year has elapsed. During this time very considerable quantities of electric steel have been made both in Sweden and in France, and have been used with most satisfactory results for all classes of tools and cutlery, and for various other purposes for which the highest class crucible steel was formerly employed, confirming in every way the conclusions of the commission that 'steel equal in all respects to the best Sheffield crucible steel can be made.'"

CHICAGO SUBWAYS.—The committee of engineers appointed by the Commissioner of Public Works to examine the underground tunnels in Chicago, has made its report. The engineers failed to find any settlement due to the first main line tunnels which were built under air pressure. All the settlements found were traced to the work done without air pressure. There have been completed 173,510 ft., or practically thirty-three miles of tunnels, and the work is now proceeding at the rate of about 500 ft. a day.

SYNCHRONIZING SYSTEM.—Another of the many proposed uses for selenium is disclosed in a patent issued August 8 to Paul Ribbe, which relates to a system by means of which a disc at the receiving station may be caused to revolve exactly synchronously with one at the transmission station. Each disc is driven primarily by clockwork, and its speed is arranged so as to be approximately



synchronous with that of the other disc. The novel features of the system reside in the means employed for obtaining exact synchronism. Each disc is provided with several radial slits through which light may pass from a lamp to a selenium cell when the disc is in certain positions. Upon the periphery of each disc are mounted soft-iron armatures corresponding in number to the number of slits. Opposite the periphery of each disc and in proximity to the armatures as the disc revolves is mounted an electromagnet whose coil is connected in series with a battery and the selenium cell of the other stations. When the discs are driven by the clockworks, they will revolve exactly synchronously on account of the fact that the electromagnet will receive an impulse of exciting current and hence will attract momentarily an armature on the periphery of the disc as each slit of the disc at the other station passes between the lamp and the selenium cell.

SMALL POWER BOATS.—The Washington correspondent of the *Iron Age* says: "The friendly offices of the Department of Commerce and Labor are being solicited by the American Association of Masters and Pilots of Steam Vessels to secure the passage in the coming Congress of a law that will place all launches and other power boats of less than 15 tons under the jurisdiction of the navigation laws, requiring those who operate them to pass examinations and take out licenses as pilots and engineers. The movement is a revival of a campaign that failed last winter and is strongly opposed by all builders of small gasoline and steam engines, electric motors, launches and pleasure boats, etc., and it is very freely intimated that the anxiety of the officials of the American Association of Masters and Pilots of Steam Vessels to secure this legislation is based less upon solicitude for the public welfare than upon the desire to impose such restrictions upon the operation of small pleasure craft as will create several thousand jobs for licensed pilots and engineers." Among those who opposed the bill in the last Congress was Mr. H. R. Sutchen, of the Electric Launch Company. He particularly opposed the application of the pending bill to the electric launch. Within the past dozen years, he said, large numbers of these small vessels had been built and were operated as easily and simply as rowboats. During the Chicago World's Fair over 1,000,000 passengers were carried without an accident of any kind. The boats were operated by young men, mostly college students, who had no license but who were perfectly competent to manage the boats.

Electrical Engineers of the Times.—XXIV.

HENRY A. LARDNER.

Mr. Henry Ackley Lardner was born in Wisconsin in 1871. After being graduated from the Milwaukee Academy, he entered the School of Electrical Engineering at the University of Wisconsin, from which he was graduated in 1893 with the degree of B. S. in electrical engineering. He then supplemented his college course with a year at the university, devoting his time to a study of electrical machine design and kindred subjects. In 1895 he received the degree of E. E. from the University of Wisconsin.

During 1895 Mr. Lardner was employed on railway construction work in Baltimore by J. G. White & Co., and during that time made a special study of rail bonding and track resistance. Following the work in Baltimore, he was instructor in electrical engineering in the engineering department of the Pennsylvania State College, State College, Pa. He spent his summer vacations in practical work, gaining experience in various branches of electrical engineering. Preferring active work to that of the educational field, he again joined the forces of J. G. White & Company in conduit construction at Buffalo. Later he became associated with the Cataract Power & Conduit Company, of Buffalo, and gained much valuable experience in the operation of high-tension cables, transformers, switchboards, etc., as well as transmission line construction and operation. This position he resigned in 1898 to become electrical superintendent for the Borough of Manhattan Electric Company, New York City. During the following year and a half Mr. Lardner was engaged in

H. A. LARDNER.

the reconstruction of this company's plant and underground distribution system, and when the company was bought out by the present New York Edison Company he was retained as engineer of tests on meters, machinery and instruments. While in this position he reorganized the meter department and other work under his charge. In January, 1900, he accepted the appointment as assistant electrical engineer of J. G. White & Co., and in June of that year he was made acting electrical engineer. In 1901 he was made chief electrical engineer, which position he now holds. In 1903 he was elected a director of J. G. White & Co., Inc.

In his present capacity Mr. Lardner is in full charge of the electrical engineering department of J. G. White & Company and is responsible for the electrical design of a number of important plants and railway and lighting systems built by J. G. White & Company in this country and abroad. He has also made a large number of financial reports which have been submitted by the company to some of the largest banking interests in this country and Europe. These reports, covering steam and electric railroad properties, electric lighting companies, gas companies and hydraulic installations, have been the basis of a number of consolidations and underwritings.

Mr. Lardner has been an active member of the American Institute of Electrical Engineers and has served on several important committees. For three years he was a member of the editing committee and for the past four years a member of the board of examiners. He is also a member of the American Society of Mechanical Engineers. Since his residence in New York City Mr. Lardner has taken much interest in the New York Electrical Society and is a past vice-president of that organization.

FIG. 1.—GENERAL VIEW OF HYDRAULIC DEVELOPMENT OF ONTARIO POWER COMPANY.

Hydro-Electric Developments of the Ontario Power Company.—I.

GENERAL PLAN.

THE Ontario Power Company was the first corporation to obtain rights from the Canadian Government to develop electric power from the Niagara River in Queen Victoria Park, but its operations along present lines date from the time when Messrs. P. N. Nunn and L. L. Nunn took up the work as chief engineers.

When these engineers came to the ground certain factors were already fixed. The existing government rights determined the location of the generating station and the use of a waterway through the park. The problems presented for solution involved the construction of an intake and headworks at some point on the Canadian bank of the river above the falls, the location of a generating station at a point best suited for the development of power and its distribution, a water connection between the intake and the generating station, a distributing and control station removed from the main power plant, and means for the delivery of the tail water.

The type of hydro-electric development that has become well known through its adoption in the pioneer development on the American side of the falls, includes a station located close to an intake and near the level of the upper river, a wheel pit beneath the station and deep enough to reach the tail water level, water wheels at the bottom and generators at the top of this pit connected by long vertical shafts, and a tunnel from the pit to the canyon below the falls to carry off the tail water. None of these features are included in the works of the Ontario Power Company. Instead of being located close to the intake above the falls, the generating station is more than a mile down stream in the gorge below. At this location the electric generators are brought down to the level of the water wheels below, and are direct-connected with short horizontal shafts, and the excavation of a wheel pit is avoided. The wheels being close to the lower river in the canyon and near its level, their draft tubes discharge the tail water without the aid of a tunnel. The intake works and the generating station more than a mile apart and differing by upward of 200 ft. in elevation, are connected by the largest steel pipe that has ever been used for conveying water.

The reasons for the adoption of this type of construction by the Ontario Power Company rest in part on the natural conditions under which the power development is made, on the franchise limitations, and on the fact that the development is almost entirely within the boundaries of the Queen Victoria Niagara Falls Park.

Niagara River has a drop of about 55 ft. in the upper rapids and approximately 158 ft. sheer drop at the falls themselves, making a total of 213 ft. It is desirable, therefore, in order to obtain a larger head and consequently a greater power with a given diversion of water from the Niagara River, that the intake works should be above the rapids that lead down to the falls. Another important reason for the location of the intake is found in the rapid formation in the turbulent water of much ice that would present serious difficulties in cold weather, if the intake were further down stream. In order to avoid the ice trouble the intake works of the Ontario Power Company were located above the upper line of rapids on the Canadian side. This location brought the forebay just outside the Dufferin Islands, a little group of islands which have been carved from the original bank by the strong river currents setting in their direction. A generating station might have been located close to these islands, but this would have involved a deep wheel pit with vertical wheels, shafts and generators, besides a tunnel nearly a mile long to carry off the tail water. There was, therefore, sought for the power station a location where the wheels and electric generators could be brought to the same level and where the draft tubes could discharge the tail water directly into the river.

The station thus located is at the base of the Canadian cliff (Fig. 2) nearly underneath that portion known as Table Rock, and rests on a narrow ledge between it and the lower river. With an intake works and generating station located more than a mile apart, it was necessary to connect them by a suitable waterway, and a closed conduit was adopted for this purpose. The shortest and most direct route for this conduit lay parallel to the river bank through Queen

FIG. 2.—MAP OF NIAGARA FALLS, SHOWING POWER DEVELOPMENTS.

Victoria Park, where an open canal would have been undesirable. Pipes, on the other hand, could be laid beneath the park surface and thus avoid detracting from the æsthetic character of the surroundings.

INTAKE WORKS.

At the intake the general plan is to intercept an ample supply of water for the ultimate power to be developed at the station, to create a large and comparatively quiet forebay, and to provide with especial

care for the elimination of ice from the water before it reaches the conduits. It was necessary to erect a stone-filled crib dam before work on the forebay could be begun, as water covered the entire area. Twenty acres of river bed were laid bare at a point nearly opposite the Dufferin Islands. The area exposed consisted mainly of limestone ledge with a surface broken with peculiar pot holes and hummocks. Geologists have found much of interest in these formations.

The excavation necessary to give the water in the forebay its required depth was carried down in this limestone bed of the river,

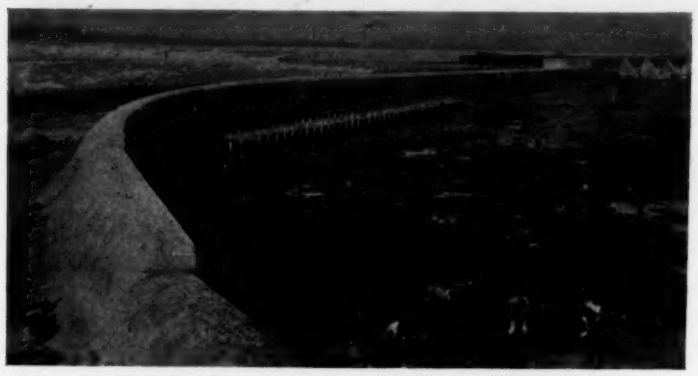


FIG. 3.—GENERAL VIEW OF RIVER WALL, OUTER FOREBAY.

and the rock removed amounted to approximately 130,000 cubic yards, varying in thickness from about 3 ft. to 22 ft. Much of the excavated rock was crushed and then used in making concrete for the forebay walls and buildings, and the cores of the wells were filled in part with irregular stones from the same source, embedded in the concrete. Part of the excavated rock was used for the formation of new islands.

Along the line of intake the low-water level of the river is 553 ft. above sea level, and this level is maintained by the forebay water down to the gate house where the present steel conduit begins. Outside of the forebay wall at the river side of the gate house, the river level is down to 540 ft. elevation, it having dropped some 13 ft. over the first cascades. Just above the line of intake piers, which extend from the bank out into the river before it reaches the first line of breakers, the depth of low water is 14 ft., and there is an increase in the forebay depth to 18 ft. at the screen house and 28 ft. at the gate house.

The intake is located at the large upstream end and the gate house at the smaller end. The length of the intake, which runs diagonally out and down stream from the river bank, is about 600 ft. The screen house crosses the forebay between its upper and lower curved portions and is 320 ft. in length. Between the screen house and the gate house the side walls of the forebay draw rapidly toward each other and are only 120 ft. apart at the latter. On the center line of the forebay from intake to screen house its length is about 880 ft., and between screen house and gate house the length is approximately 315 ft., besides a width of 30 ft. in the screen house. Between the intake and the screen house the forebay area is about 8 acres, and between screen house and gate house the area is about 2 acres.

When 2,500 cu. ft. of water per second are passing over the waste weir in this forebay, which is a waste discharge permitted when the forebay is at low-water level of 553 ft., and when in addition a sufficient amount of water is being drawn from the head gates to operate a station having a capacity of 180,000 electrical hp, not more than one-half the water that reaches the intake from the outer river can enter. This large excess of intercepted water over full-load requirements more than provides for an ample supply under any conditions of flow that are even remotely probable in the Niagara River. To operate the station with a full load, it is estimated that about 12,000 cu. ft. of water per second must be drawn from the forebay by the conduits, and this with the 2,500 cu. ft. per second discharged over the waste weir, brings the maximum demand for water at the intake up to about 14,500 cu. ft. per second.

When the river surface at the intake is above its low level of 553 ft., which is the case for large parts of each year, a quantity of water greater than the maximum just named may enter the forebay. For the discharge of this excess of water the entire river wall of the forebay between the outer end of the intake and the screen house, a length of about 700 ft., will act as a waste weir. Except for the length of 100 ft. of this wall next the screen house, its top elevation is 553 ft., or just that of "low water." Fifty feet of the wall next the screen house has an elevation of 549 ft., and the next 50 ft. upstream is at the level of 551 ft., so that this lower 100-ft. section of the wall acts as the permanent waste weir for the discharge of the 2,500 second-feet above mentioned.

Between the screen house and gate house the river wall, a view of which is given in Fig. 3, has an elevation of 560 ft., so that no water can escape over it, and the same is true of the entire landward wall of the forebay. Sluiceways in the core wall running through the made islands permit water from the outer and inner forebays to enter the channels about the Dufferin Islands, and this water escapes into the river at a point a little down stream from the head gates, passing over the conduits.

Perhaps the most notable feature of the forebay is the provision that has been made for the exclusion of ice at the intake, and for its discharge into the river should it enter. The intake constituting the outer protection, consists of a line of concrete piers set 20 ft. apart and connected along their tops and for some distance down their upstream faces by platforms, and by a curtain wall of concrete reinforced with embedded steel rods (see Fig. 4). Stop logs will be suspended freely on the river side of the curtain wall to act as an ice barrier, also to regulate the amount of water admitted. On top these piers and platform have an elevation of 560 ft., or 7 ft. above the low-water level of the river. From the top of this wall the concrete barrier drops down for a distance of 12 ft., or 5 ft. beneath the low-water line. At the upstream face of the piers they stand 18 ft. above the ledge of the river bed, which as excavated is at elevation 542, and there is, therefore, a distance of 6 ft. between the lower edge of the wall or barrier and the bed rock. All water entering the forebay must pass through these submerged openings at the intake.

The natural river currents in front of the intake will strike the ice barrier at an angle of about 30°. When water for the development of 180,000 hp is being drawn from the forebay the velocity of water entering the intake will probably be not more than 4.4 ft. per second. As not more than one-half of the water reaching the intake

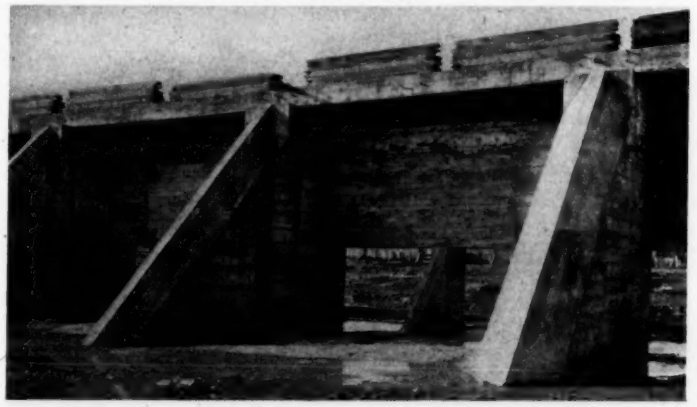


FIG. 4.—VIEW OF INTAKE PIERS AND CURTAIN FROM DOWNSTREAM SIDE.

works will be drawn under this barrier, a strong cross current will result on the surface that will sweep the upstream face and tend to carry any ice that reaches the wall out into the rapids. Very little cake or floe ice can enter the forebay because, under the lowest water conditions, it must sink more than 5 ft. below the surface of the river in order to pass under the barriers.

With the maximum draft of water at the head gate for full-load requirements, the velocity of water just inside the intake will be about 2.9 ft. per second, along down the outer forebay the maximum of 4.7 ft. per second will be attained, and just before it reaches the screen house the minimum of 2 ft. per second.

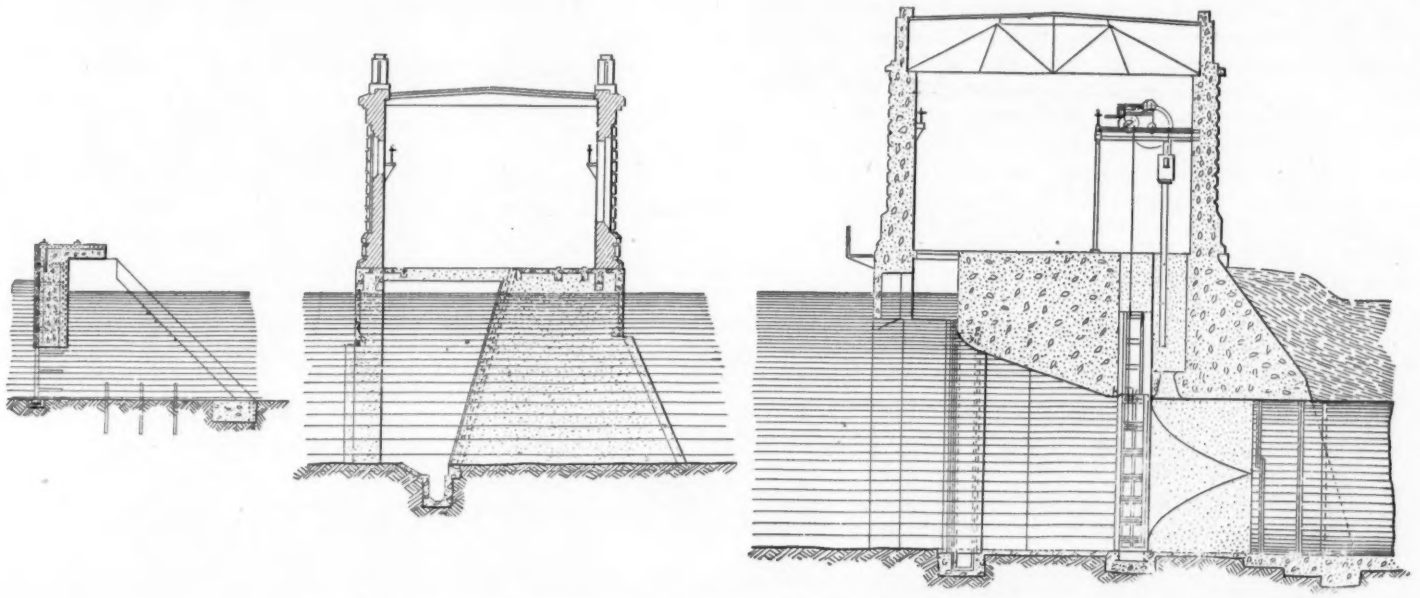
Along the upstream side of the screen house, which is 320 ft. long, and spans the entire width of the forebay, a reinforced concrete wall or barrier extends vertically downward from elevation 558 to 549, or to a point 4 ft. beneath the low-water level of the forebay. This curtain wall stops the entry of surface ice to the screen house and, together with the waste weirs in the river wall of the forebay at the downstream end of the screen house, produces a surface current toward the weirs which sweeps floating ice into the river. After passing under the curtain wall the velocity continues at 2 ft. per second in front of the screens inside, and rises to 2.9 ft. per second while passing through the screens, and reaches a velocity of 2 ft.

per second beyond the screen house. On to the gate house from this last point the velocity gradually increases to 3.4 ft. per second at the upstream side of the gate house and to about 5 ft. per second at the beginning of the taper entrances to the main conduits that lead through the park to the cliff above the generating station. The taper section above mentioned is constructed of reinforced concrete and, after entering, the water gradually attains, under full-load conditions, a velocity of approximately 15 ft. per second, which velocity is maintained down to the distributor section of the conduit. The low velocity of 2 ft. per second inside of the screen house serves two important purposes, the first being that it allows the water to drop any sand or silt it may be carrying into a ditch or channel that extends entirely across the forebay just in front of the screens. This ditch in the rock floor of the forebay is 2 ft. wide by 4.5 ft. deep and connects with the river through an arched opening beneath the forebay wall. Not only sand and silt dropped by the water, but also stones swept along the forebay floor are carried out into the river through this opening in the wall. The second purpose served is that any ice still remaining in the water is given an excellent opportunity to rise to the surface inside the screen house, when it may be discharged through an ice run 5 ft. wide by 8½ ft. deep, with its sill approximately 3 ft. below the low-water level of the forebay.

At the gate house the water encounters another curtain wall and a rack or screen. The wall is of concrete reinforced with steel and extends from the top of the foundation at elevation 560 down to elevation 552, or one foot below the low-water level. Beyond this curtain wall and in front of the entries to the main pipes is a second set of screens with a coarse mesh. In the forebay wall at the river end of the gate house there is an ice run 5 ft. wide by 4 ft. deep having its sill 3 ft. beneath the low-water level of the forebay. Into this run the curtain wall deflects any floating ice that may reach the gate house. Any ice that may pass under this last curtain and rise in front of screens may also be deflected into the ice run by a short cross channel connecting with it.

As may be seen from the foregoing description, any ice carried down the Niagara River must pass under three curtain walls that drop 5 ft., 4 ft. and 1 ft., respectively, below the low-water level, must escape three cross currents that sweep the faces of these curtain walls and tend to carry it into the river, must escape two ice runs with their minor currents, and must work its way through two screens in order to reach the head gates of the main pipes. The first screen or rack is within the screen house, runs its entire length of 320 ft., and extends from elevation 535 ft. at the forebay floor to elevation 558 ft., or 5 ft. above the low-water level. The spaces between the flat steel strips forming the racks are 2 in. across, while the strips are 3 by 5/16 in. set edge on to the current. Above the top of the screen the house has a height of 19 ft. 2 in. and a width of 25 ft. 4 in. In structure this house has reinforced concrete sides and roof, the exterior being faced with concrete slabs molded to simulate stone. The walls carry a traveling crane equipped with an electric hoist for lifting and changing the individual screens.

The gate house is also a concrete building with veneer of imitation stone. Both the screen house and the gate house, as well as the other buildings which the company is erecting within the park, although built of concrete, are of such architectural design and finish as to please the most fastidious in such matters. The gate house has a length of about 120 ft. over the entry of the three main conduits. The so-called headblock that forms at once the entry for these pipes, the framework for the head gates and the foundation for the gate house, is a monolith of concrete approximately 120 ft. long, 57 ft. wide at its base and 40 ft. wide at the top, rising 35 ft. above the limestone bed of the forebay. One pipe 18 ft. in diameter and two stubs for conduits each 20 ft. in diameter are imbedded in this headblock and the entry to all is guarded by a light screen with meshes 2 by 6 in. Instead of expanding the end of each pipe into an entry, the enlarged opening on the forebay side is formed in the concrete itself and gradually changes from an 18-ft. square to a circle of the diameter of the pipe. For each pipe the entrance on the forebay side of the headblock is approximately 38 ft. wide and 24 ft. high, and its cross-section shrinks to that of the pipe in a length of 34.5 ft. In front of each, to control the entry of water to the conduits, there is a steel gate of the Stoney type 20 ft. square, with its guides imbedded in the headblock (see Fig. 7). Each of these gates is counterbalanced, moves against roller guides, rests on a steel sill and lintel when down and is raised and lowered by means of an induction motor connected through gearing. The friction overcome in moving these gates, in spite of the fact that the head of water above the lower edge of the gate is at least 28 ft., is so small that a motor of only 5 hp is sufficient for the work of operation.



FIGS. 5, 6 AND 7.—SECTIONS THROUGH INTAKE, SCREEN HOUSE AND HEADBLOCK.

The Boston Edison Company Fights Municipal Ownership.

Telling work against the cause of municipal ownership is being accomplished by the Edison Electric Illuminating Company, of Boston, in its monthly publication, "Edison Light." This little magazine is regularly mailed to customers and other interested parties on the company's list, and in almost every issue extracts from the work of reliable writers and speakers in different parts of the country are reprinted in succinct form, showing clearly the fallacy of municipal ownership of public utilities employing large numbers of men. In a recent issue the company discussed every item of expense tabulated in the report of the Massachusetts Gas & Electric Light Commission and showed clearly how little if any saving in operating cost could be expected under the political management, which in this country at least is inseparable from municipal ownership. The recent visit of the Scotch expert, Mr. James Dalrymple, to Chicago, with his discouraging conclusions, is also mentioned, thus reaching a large part of the public who seldom would otherwise see the real truth of this *ignis-fatuus*.

Reactance E. M. F. and the Design of Commutating Machines.

By C. A. Adams.

At the Asheville Convention of the American Institute of Electrical Engineers, June, 1905, Mr. Senstius read a very interesting paper entitled "Limitations in Direct-Current Machine Design," in which he developed and applied a formula for the "reactance volts" of commutation, as defined by Hobart.

Working along similar lines, the writer last winter developed a formula for the same quantity, but expressed it in terms of the *design constants,* so that the latter may, at the outset of a design, be given such values as to yield a reactance e.m.f. within the desired limit. This formula makes possible a straightforward rational determination of the minimum safe number of commutator bars, and shows clearly the manner in which the several fundamental design constants affect the commutation.

The term *commutation belt* will be applied to the set of adjacent[1] conductors which are undergoing commutation at the same instant.

Designate by $\phi' e$ the *flux* (maxwells) *per ampere-inch of embedded length of commutation belt;* i. e., the equivalent flux that would be linked with one inch of embedded length of the belt as a whole, when a current of one ampere flows through the belt, distributed uniformly throughout all of its conductors.

It is obvious that in general the number of conductors in the commutation belt varies with different positions of the armature, and that ϕ'_e also varies because of the change in relative location of the belt conductors and the consequent change in equivalent permeance of the leakage flux path. The *average* values of these quantities will be here considered, as well as the *average*[2] *value of the reactance e.m.f.*

It is hardly necessary to discuss here the method of calculating $\Phi' c$, as this subject has been thoroughly treated by Arnold,[3] Niethammer[4] and others; it is important, however, when making this calculation, to take note of the definition of $\phi' e$ as given above.

Let k_b = the fraction of the pole-pitch angle subtended by the brush.
λ_p = the pole-pitch at the gap circumference (inches).
Δ = the peripheral current density, ampere conductors per inch of periphery.
I = the average current in a single armature conductor.
l_p = length of pole-arc (inches).
$k = \frac{l_p}{\lambda_p}$ = ratio of pole-arc to pole-pitch.
p = number of pairs of poles.
p' = number of pairs of paths in armature winding.
N' = conductors per coil.
l = length of core, in inches, excluding air ducts.
v = peripheral velocity of armature in feet per second.
B = mean gap density at pole-face (maxwells per sq. inch).
e'' = average volts per inch of active conductor, due to cutting of main flux; it is
$e'' = 12\, k\, v\, B\, 10^{-8}$.
e_b = average volts per bar of commutator.
E = terminal volts.

AVERAGE BREADTH OF COMMUTATION BELT.

For a *multiple-circuit*[5] *winding* or for a *two-circuit*[5] *winding with two sets of brushes,* this is $k_b\, \lambda_p$; i. e., it corresponds to the width of brush, the insulation between commutator bars being neglected.

For a *two-circuit* winding with $2p$ *sets of brushes,* there are two short-circuit paths[6]; the long path through the $2p$ conductor units which are in series between the two bars covered by one brush, the same as when only two sets of brushes are used; and the short path through two conductor units in series between two adjacent[6] brushes of the same polarity. The actual short-circuit phenomena include currents in both paths, the short-path currents predominating at the beginning and end of the commutation period. As the long path is considered in connection with the two-brush, two-circuit winding, the short path will be considered here. Then for a machine with *many poles,* the two bars which terminate a single coil enter under two adjacent[7] positive (or negative) brushes at almost the same instant, and leave at almost the same instant. Thus the breadth of commutation belt corresponds to the width of brush plus that of one bar. In a *four-pole* machine is corresponds to the width of brush plus that of one-half bar, in a *six-pole* machine to the width of a brush plus that of two-thirds of a bar, etc. In general the width of the short-path commutation belt, in this type of machine, may be expressed as follows:

$$\lambda_p \left(k_b + \frac{p-1}{p} \frac{e_b}{E} \right)$$

where E is the terminal e.m.f. of the machine.

The difference between this and that for the multiple-circuit armature increases with e_b and p.

Take an example: $k_b = 0.07$, $p = 12$, $e_b = 3$, and $E = 125$; the expression in the parenthesis is equal to 0.09, or nearly 30 per cent larger than k_b, which corresponds to the long path belt, or to machines in which the number of circuits and the number of sets of brushes are the same. Therefore, *with a given width of neutral field the brushes of this type of machine should be narrower* (k_b smaller) *than for the machine with equal numbers of circuits and brush sets.*

INDUCTANCE.

Consider first armatures (multiple-circuit or two-circuit) with as many brush-sets as circuits[8].

Embedded Length.

The average number of conductors in the commutation belt is:

$$\frac{\Delta\, \lambda_p\, k_b}{I}$$

and the average flux (maxwells) per embedded inch of belt for one ampere in each conductor of the belt is:

$$\phi e_b = \frac{\Delta\, \lambda_p\, k_b}{I}\, \phi' e.$$

$$\frac{e_b}{e''} = \text{inches of active conductor in } \frac{p}{p'} \text{ coils} = \frac{e_b\, 10^8}{12\, k\, v\, B}.$$

$$\therefore \quad \frac{e_b}{e''} \frac{p'}{p} = \frac{e_b\, 10^8\, p'}{12\, k\, v\, B\, p} = \text{inches active conductor per coil,}$$

and

$$N' = \frac{e_b\, 10^8\, p'}{2l \times 12\, k\, v\, B\, p}.$$

Then the flux linkage per coil, for the embedded length, per ampere in each conductor of the whole belt, is:

$$2l\, \phi e_b\, N' = \frac{\Delta\, k_b\, \lambda_p\, e_b\, 10^8\, p'}{12\, k\, v\, B\, I\, p}\, \phi' e$$

and the inductance of the embedded length per coil, in henries, is:

$$L_e = \frac{\Delta\, k_b\, \lambda_p\, e_b\, p'}{12\, k\, v\, B\, I\, p}\, \phi' e. \qquad (1)$$

Free Length.

The free length per active conductor is approximately $lf = 1.35\, \lambda_p$. The number of conductors in a commutation-belt-bundle of end connections is only half that of the active belt; it is $\frac{\Delta\, k_b\, \lambda_p}{2I}$, and the flux per inch of free belt per ampere in each conductor is $\phi f_b = \frac{\Delta\, k_b\, \lambda_p}{2I}\, \phi' f$, where $\phi' f$ bears the same relation to the free belt as $\phi' e$ to the embedded belt.

Then the *flux linkage* per coil, for the free length, per ampere in each conductor of the free belt, is $2lf\, N'\, \phi f_b$, and the inductance of the free length per coil, in henries, is:

$$Lf = 2lf\, N'\, \phi f_b\, 10^{-8} = \frac{.68\, \lambda_p}{l}\, \phi' f\, \frac{\Delta\, k_b\, \lambda_p\, e_b\, p'}{12\, k\, v\, B\, I\, p} \qquad (2)$$

The *total inductance per coil* is thus:

$$L = L_e + Lf = \frac{\Delta\, k_b\, \lambda_p\, e_b\, p'}{12\, k\, v\, B\, I\, p} \left(\phi' e + \frac{.68\, \lambda_p}{l}\, \phi' f \right) \qquad (3)$$

But $\lambda_p = \frac{l_p}{k}$, where l_p = pole-arc, and $\frac{.68}{k}$ is, in the great

majority of machines, very nearly unity; therefore,

$$L = \frac{\Delta\ k_b\ \lambda_b\ e_b\ p'}{12\ k\ v\ B\ I\ p}\left(\phi' e + \frac{l_b}{l}\ \phi' f\right) \qquad (4)$$

In most direct-current machines the ratio $l_b \div l$ does not differ much from unity; (4) then becomes *approximately*:

$$L = \frac{\Delta\ k_b\ \lambda_b\ e_b\ p'}{12\ k\ v\ B\ I\ p}\ (\phi' e + \phi' f) \qquad (5)$$

For a *multiple-circuit winding* $p = p'$, and there is only one coil in series between adjacent commutator bars; therefore, the inductance for this case is:

$$L_m = \frac{\Delta\ k_b\ \lambda_b\ e_b}{12\ k\ v\ B\ I}\left(\phi' e + \frac{l_b}{l}\ \phi' f\right) \qquad (6)$$

For a *two-circuit* winding with two brush sets, there are $\frac{p}{p'}$ coils in series between bars, and the inductance is:

$$L_2 = \frac{\Delta\ k_b\ \lambda_b\ e_b}{12\ k\ v\ B\ I}\left(\phi' e + \frac{l_b}{l}\ \phi' f\right) \qquad (6a)$$

These equations are not identical, since the amperes per conductor I, are different for the two machines.

FREQUENCY OF COMMUTATION.

For the two types above considered, the commutation frequency is:

$$n_c = \frac{6\ v}{k_b\ \lambda_b}. \qquad (7)$$

REACTANCE VOLTS.

The *reactance per coil* is then $x = 2\pi\ n_c\ L$ and the reactance volts,

$$E_R = I\ x = 2\pi\ n_c\ L\ I = \frac{\pi\ \Delta\ e_b}{k\ B}\left(\phi' e + \frac{l_b}{l}\ \phi' f\right) \qquad (8)$$

Thus the reactance e.m.f. of the *multiple-circuit* winding is the same as that of the two-circuit, two-brush winding.

$$\text{Let } \phi' = \left(\phi' e + \frac{l_b}{l}\ \phi' f\right)$$

and take $k = 0.7$, which is sufficiently accurate for the present purpose, then

$$E_R = 4.5\ \frac{\Delta\ \phi'}{B}\ e_b. \qquad (9)$$

TWO-CIRCUIT WINDING WITH $2p$ BRUSH SETS.

For the *long path*, the reactance e.m.f. is given by equations (8) and (9). For the *short path*, the average width of commutation belt is, as shown above,

$$\lambda_p\left(k_b + \frac{p-1}{p}\ \frac{e_b}{E}\right) \qquad (10)$$

The number of conductors in the belt and the inductance per coil will be increased nearly in the same ratio as the belt width. But it is easily seen that the period of commutation also increases in this same ratio, and the frequency in the reciprocal ratio. Thus the increase in the inductance is balanced by the corresponding decrease in the frequency, and the *reactance e.m.f.* for the *short path* is:

$$E_{Rs} = \frac{\pi\ \Delta\ e_b\ p'}{k\ B\ p}\left(p' e + \frac{l_b}{l}\ \phi' f\right) \qquad (11)$$

or

$$E_{Rs} = 4.5\ \frac{\Delta\ e_b\ p'}{B\ p}\ \phi'. \qquad (12)$$

If (12) could be used as the sole criterion in design, it is obvious that this type of machine would have a very considerable advantage over the other types, from the standpoint of commutation; but when the number of poles is large (just when the advantage would be greatest), the reactance e.m.f. is more closely represented by equation (9). An example will make this clear:

Consider a 12-pole machine, and assume a reactance e.m.f. of one volt per coil; then

	Long path.	Short path.
Reactance e.m.f.	6	1
Brush contacts in series	2	2
Coils in series	6	1
Approximate total resistance in arbitrary units	3	2.2

Although this is a very rough analysis, it shows that much the larger part of the current will take the long path, and that the effective reactance e.m.f. will be somewhat less than that given by equation (9); how much less, it is difficult to determine with any degree of accuracy.

CONCLUSIONS AND DISCUSSION.

The *reactance e.m.f.* is, other things being equal, independent of the *voltage* and *capacity* of the machine, independent of the *peripheral velocity*, and independent of the *brush width*.

The *brush width* should be as great as is consistent with the width of the neutral field. An average value of k_b is 0.08; but a still better criterion is $k_{bm} = k_b \div (1 - k)$, since this is the ratio of the angle subtended by the brush to that subtended by the interpolar distance, or the neutral field. A conservative value for this ratio is 0.25. Other things being equal, a thick brush means a smaller value of $\phi' e$ and $\phi' f$, owing to the increase in belt width.

The *reactance e.m.f.* is proportional to the average volts per bar, e_b, to the peripheral current density, Δ, and inversely proportional to the mean gap density, B.

A large value of Δ requires relatively deep slots and therefore a larger $\phi' e$, so that E_R increases more than in proportion to Δ,

Referring now to equation (9), the safe limit of E_R is determined by the resistance of the short-circuit path, which consists chiefly of the brush contact resistance (unless high-resistance commutator leads be employed).

Assuming E_R to be thus determined, we have

$$e_b = \frac{B\ E_R}{4.5\ \Delta\ \phi'}, \qquad (13)$$

which determines the minimum number of commutator bars per pole. It is:

$$\frac{E}{e_b} = 4.5\ \frac{\Delta\ \phi'\ E}{B\ E_R}, \qquad (14)$$

and the minimum brush pitch (the pole pitch at commutator surface), is:

$$\lambda_b = 4.5\ \frac{\Delta\ \phi'\ E}{B\ E_R}\ t_b, \qquad (15)$$

where t_b is the minimum allowable thickness of bar at surface of commutator, including insulation.

But $\lambda_b = \frac{360\ v_c}{p \times R}$, where v_c = peripheral velocity of commutator (feet per second), and R is the speed in revolutions per minute. Therefore, the *maximum allowable* value of *pairs of poles* $\times$ *revolutions* is:

$$p \times R = \frac{80\ v_c\ B\ E_R}{\Delta\ \phi'\ t_b\ E}. \qquad (16)$$

Since the peripheral velocity of the armature is limited mechanically, equation (15) practically places a lower limit on the pole pitch, thus the minimum safe pole pitch is:

$$\lambda_p = \lambda_b\ \frac{v}{v_c} = 4.5\ \frac{v}{v_c}\ \frac{\Delta\ \phi'\ E}{B\ E_R}\ t_b. \qquad (17)$$

If electromagnetic commutation be employed, the limit for E_R may be set somewhat higher, which will make the above safe maxima higher and the minima lower.

Numerous interesting conclusions may be drawn from the above equations, some of which are old friends. Some of the most general are as follows:

Assuming E_R and ϕ' to be fixed, the high-voltage machine should in general have:

1. A lower peripheral velocity of armature, v.
2. A higher " " " commutator, v_c.
3. A lower " current density, Δ.
4. A higher gap density, B.

5. A larger pole pitch, λ_p.

6. A smaller number of poles (constant r.p.m. assumed).

7. Thin commutator bars.

(*a*) 1 means a small diameter, *d*...

(*b*) 1 and 3 mean a larger projected area of armature, *dl*, although partly neutralized by 4.

(*a*) and (*b*) mean a greater length of core, *l*.

(*c*) 3 and 5 will more or less neutralize each other as far as the armature ampere-turns per pole are concerned. Assuming, on this basis, that the field ampere-turns per pole are approximately the same, the neutral field will be *flatter* and *broader* unless *k* be increased.

(*d*) Thus a thick brush may be used, although it is more conservative to retain the same brush thickness and to take advantage of the flatter field to offset the larger value of E_R, which it is sometimes difficult to avoid.

(*e*) The smaller current of the high-voltage machine means narrower (axially) brushes and a shorter commutator.

There are many and obvious reasons why all of the above differences should not appear in any one case; but the analysis shows the general tendency of direct-current design as affected by the Hobart criterion of commutation.

Many of the conclusions are not new, but the method is new and is readily susceptible of application to the quantitative solution of design problems. The method is essentially the same as that employed in the writer's recent paper on "Induction Motor Design."[10] This article is in fact a corollary to that paper and was developed at the same time.

Regulation of Gas and Electric Rates in Massachusetts. II.

(*Concluded.*)

By Alton D. Adams, LL.B.

On the question of what a gas company should be allowed to earn, the commissioners said: "In addition to the cost of manufacture or a fair price for gas purchased and a fair cost for distribution, including management and tares, the Board believed it necessary and advisable to add a fair allowance for depreciation, and extensions or improvements. Extraordinary demands for extensions may properly be met by the issue of new capital, but the ordinary demands which a progressive management desires and is bound to meet may fairly be provided for out of income when the price of gas is not made so high as to be burdensome. This is the course which has been pursued by the best managed companies in this State for a long term of years—by those in which the prices are the lowest—and has probably contributed more than any other single factor to make these low prices a possibility. A study of the history of the business will show that the benefits arising from the increase of population and output are most surely secured to the consumer by an adherence to this policy. By this the capital charge is kept low, and the relation of capital to output is perhaps the most important single factor bearing upon the cost of gas to the consumer. It proves advantageous to the public by making a low price possible, and to the shareholder by adding security to his investment. An increased consumption demands added facilities for manufacture and distribution, and if the share capital remains the same, the amount per 1,000 cu. ft. which consumers must pay for fair and reasonable dividends rapidly decreases."

3. In 1892, certain consumers supplied by the East Boston Gas Light Company brought a petition before the Commissioners asking a reduction in price and an improvement in the quality of its gas. The candle power of this gas had been constantly above the standard fixed by statute, and at the public hearings on the petition the question of price was the main point of contention. No order as to the quality of gas was made by the commissioners in this case, but they fixed the price at $1.50 net per 1,000 cu. ft., from and after the first day of May, 1893, and the company adopted this price. Prior to the date just named, the regular net price of gas sold by the East Boston company was $0.25 higher per 1,000 cu. ft. On June 30, 1892, the capital stock of the East Boston company was $220,000, and it had no bonds or notes outstanding. During the year ending on that date, the latest year for which the reports of gas companies were before the commissioners when they fixed the price in East Boston, the East Boston company had a gross income of $77,369.07 from its gas business, and its entire operating expenses were $55,087.87. This left a net income of $22,281.20, and of this $22,000, or 10 per cent on the capital stock was paid out in dividends. Gas to the amount of 39,471,423 cu. ft. was sold in this year, at the gross price of $1.85, the net price of $1.75, and the average price of $1.76 per 1,000. On this volume of sales the capital of the company amounted to $4.06, and the dividends named to 55.73 cents per 1,000 cu. ft. of gas. Per mile of main the gas sold was 1.9 million cu. ft., and the cost of this gas to the company less the sum received for residuals was $1.16 per 1,000 cu. ft., at the meters of consumers. This total cost was made up of 72.84 cents net in the holder, and 43.72 cents from holder to burners. If the reduction of 25 cents per 1,000 cu. ft. in the net price of gas, made by the commissioners, had been in force on the sales of 39,471,423 cu. ft., in the year under consideration, the net earnings that might have been applied to dividends would have been reduced by about $9,867, or to 5.64 per cent of the capital stock. Prior to the year ending June 30, 1892, the East Boston company had accumulated a surplus, and had invested a part of it in securities that bore interest. From this source the company received interest to the amount of $2,934.55, during the year in question, and this interest was 1.33 per cent on its capital, so that with net earnings and interest a dividend of 6.97 per cent might have been paid, even under the rate subsequently fixed by the commissioners.

At Taunton the sales of gas were 38.3 million cu. ft., or about one million less than in East Boston during the year ending June 30, 1892, and the price charged by the Taunton company was $1.50 gross and $1.47 average, per 1,000 cu. ft. While the average candle power of gas in East Boston was 17.41, that in Taunton was 18.21, and both companies made coal gas only. The Taunton company sold 1.8 million cu. ft. per mile of main, or 0.1 million cu. ft. less than the South Boston company.

In this same year the Malden Gas Light Company sold a total of 36.3 million cu. ft., and had only 569,000 cu. ft. per mile of main, at a cost to itself of 95.65 cents per 1,000 cu. ft., the entire product being coal gas. This cost was made up of 55.70 cents, the net cost in the holder, and of 39.95 cents, the cost of distribution from holder to burner, per 1,000 cu. ft. sold. Gas sold by the Malden company had an average candle power of 17.24, or very nearly the same as that sold by the East Boston company. The net cost in the holder at East Boston was 72.84 cents per 1,000 cu. ft., or 17.14 cents higher than the like cost in Malden. This excess of cost in the holder for East Boston gas was mainly due to a charge of 26.09 cents for repairs and maintenance of the manufacturing plant there, while the corresponding charge on the Malden plant was 8.40 cents per 1,000 cu. ft. sold. For the distribution of gas by the East Boston company the entire cost including management and taxes was 43.72 cents from holder to burner, while the like cost in Malden was 39.95 cents per 1,000 cu. ft. sold. Between these two distribution costs the difference is 3.77 cents, and this was more than covered by the higher charges for management and for repairs and renewals by the East Boston company. In Malden the taxes of the gas company amounted to 13.09 cents per 1,000 cu. ft. sold, and the corresponding tax of the East Boston company was 13.78 cents. On both manufacture and distribution the entire cost of operation was 20.91 cents less to the Malden company than to the East Boston company per 1,000 cu. ft. sold by each. If the East Boston company had made and distributed gas at as low a cost as the Malden company, or say 96 cents per 1,000 cu. ft. during the year ending June 30, 1892, and if the rate of $1.50 per 1,000 cu. ft., subsequently fixed by the commissioners, had been in force on the sales of that year, the

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[1] In the case of chord windings, the conductors in question are not immediately adjacent and the problem does not admit of any simple general statement. This class of windings will be excluded from the present treatment.

[2] This is on the whole quite as good a criterion as the maximum value, as calculated by Hobart, since in that calculation $\phi' \epsilon$ is assumed to be constant, whereas it is generally a minimum when the number of conductors in the commutation belt is a maximum; moreover, during the period when the number of conductors in the comutation belt is a maximum, the brush-contact resistance of the short-circuit path is also a maximum. Both of these relations reduce the importance of the maximum as compared with the average reactance e.m.f.

[3] "Die Gleichstrommaschine," Vol. I, Chapter 18.

[4] Berechnung und Konstruktion der Gleichstrommachinen," Ferdinand Enke, Stuttgart, 1904.

[5] These may be either simplex or multiplex.

[6] See Hobart, "Electric Motors," page 48.

[7] Two poles apart.

[8] This applies equally well to *multiplex* windings; but if the winding be *n plex* there will be *n* times as many circuits as brush-sets.

[9] The brush contact resistance is not constant, but varies as the bar passes under the brush.

[10] A. I. E. E., June, 1905.

East Boston company would have derived a net income of $21,314.55 from its gas business. This net income would have paid a dividend of 9.68 per cent on the capital stock of the company, and it would have had the interest derived from its investment in securities besides. It had been the policy of the company throughout its history to lay aside a part of its annual profits, and at the time the commissioners fixed the rate just considered, the surplus thus accumulated was above $80,000, fully one-half of which was invested in securities. The remainder of the surplus was invested in the plant and business of the company.

The commissioners said in their opinion on the case that the grounds for any considerable reduction in the price of gas charged by the East Boston company must rest in a measure upon what was a fair treatment of its surplus, and that the interests of the public demanded that a part of the surplus be invested in the plant. Though a reduction in price usually results in an increased output of gas, this is not always the case, but the surplus of the East Boston company was said to be a sort of insurance fund against possible loss from lower rates. With this idea, the commissioners fixed a lower price in East Boston than the figures for cost and output alone seemed to warrant. As to rights in the surplus that the East Boston company had invested in securities the commissioners said: "In this consideration it becomes an important and difficult question to determine the proper use to which these investments should be put, to discover what are the equitable interests of the stockholders and the public in them, and to determine how far and in what way the consumer may properly reap advantages for such accumulation. In view of all the relations existing between the parties in interest, the board is unable to agree that it should be treated as the exclusive property of either. If the affairs of the corporation were to be wound up by proceedings for dissolution, this sum would unquestionably belong and be distributed ratably to the shareholders. They have, to-day, an undoubted legal right to convert these securities into cash and to divide the proceeds in the same manner as they would distribute any other portion of their profits. Supch a course, however, would unquestionably be against the interests of the corporation and would probably prove fatal to its prosperity. . . . From the public the company has received, without any consideration, and at a time when it was probably not prepared to pay a consideration, a franchise which, although of doubtful value then, has proven since to be of the highest value to its owners. Very much of the company's profits has come from the natural growth of wealth and population in the territory which it supplies and to which its corporate management has directly contributed but a small share. This surplus must, we believe, be regarded as the combined result of a wise corporate management and the contributions on the part of the public. It would seem that the company is under obligation to so use a surplus of this character that substantial advantages may accrue from it to the public, and such a cause will bring added strength to the corporation itself."

4. Before the close of 1892 certain of its consumers petitioned the commissioners for a reduction in the rates charged by the Springfield Gas Light Company. After hearings on the petition the commissioners, on April 14, 1893, fixed the net price of gas supplied by the Springfield company on and after the first day of the following May at $1.40 per 1,000 cu. ft. This was a reduction of 35 cents per 1,000 cu. ft. in the net price of gas to ordinary consumers. Since 1848 the Springfield company had operated the only gas system in that city, and in 1879, it began to distribute steam for heating buildings. On June 30, 1892, the capital stock of the Springfield company was $500,000, and its notes payable were $45,000. Not all of this capital seems to have been invested in the gas business, for the company valued its steam plant and system at $72,741. During the year ending June 30 the company derived an income of $164,067.47 from the sale of gas and residual products, and its operating expenses were $104,049.67, so that the net income from the gas business was $60,017.80. No income from the steam heating business was reported for this year, and it is most probable that the distribution of steam had previously been abandoned. During at least a part of the time that the steam heating system was in operation, it had been necessary to support it with profits from the gas business. In the year under consideration, the company paid in interest $2,568.13, and this sum deducted from the net earnings left a profit of 11.48 per cent on the capital stock. Dividends of 8 per cent were paid. Gas sales for this year amounted to 84,935,720 cu. ft., at the regular net rate of $1.75, and the average rate of $1.69 per 1,000. This was all coal gas of 18.31 average candle-power, and 1,843,000 cu. ft. were sold per mile of main. Per 1,000 cu. ft. of gas sold, the capital and notes of the company amounted to $6.94, and the dividends paid for the year to 47.09 cents. This gas cost the company 98.10 cents net at the burners per 1,000 cu. ft. sold, made up of 67.17 cents net in the holder, and of 30.93 cents from holder to burner. If the net rate of $1.40 per thousand, as fixed by the commissioners for gas sold on and after May 1, 1893, had been received on sales during the year ending June 30, 1892, the business would have yielded an income of $35,588 above operating expenses. After deducting from this the sum of $2,568.13 paid as interest in that year, the remainder of the gas income would have amounted to 6.60 per cent on the capital stock.

In this same year the gas company in Haverhill sold 52.8 million cu. ft. of gas at the regular net rate of $1.40 per 1,000. One-half was coal and the remainder was water gas, the average candle power of the mixture was 20.79, and the sales amounted to 2.2 million ft. per mile of main. The net cost of gas sold by the Haverhill company was 98.73 cents per 1,000 cu. ft., or 0.63 cent more than that sold by the Springfield company. In the holder at Haverhill the cost of gas was 68.40 cents net, and from holder to burner 30.33 cents per 1,000 cu. ft. sold, so that the holder cost was within two cents, and the distribution cost within one cent of that at Springfield.

The commissioners said in their opinion on the case that the most important facts to be considered in fixing a fair price for the gas, were the capitalization, the steam department, the present condition of the plant and recent profits. It was stated that in fixing the price of gas the principle that money invested in the steam heating plant should look to the steam business alone for profits was followed. From an examination of the gas plant it was evident that large sums must be expended for extraordinary repairs and extensions in the near future, if the business of the company increased at its normal rate. It appeared that the capital stock of the company had gradually been increased from less than $50,000 to $500,000, and that a very large percentage of this increase had been paid for directly or indirectly by the divided profits of the business, though the payments seemed to have been made in cash. "The policy seems to have been to maintain the capital on a level with the construction account by declaring dividends to the amount of its increase and issuing new stock for the same amount." Perhaps the most important feature of the case was these facts as to the increase of stock, in the opinion of the commissioners. All profits of the company ordinarily belong to the shareholders and may be divided among them, even when invested in the plant, but such a course is against the interests of the company and the spirit of existing legislation. and leads to a higher capital in proportion to output than sound policy can approve. Speaking further on this point, the commissioners said:

"It is important to consider, however, that every dollar of the new capital issued in this manner in this company was represented by money actually put into the development of the plant and that the entire capital is fairly entitled to dividends, although at a lower rate than might be permissible under a different policy." It was pointed out in the opinion that the reduction in rates made by the commission must result in a reduction of the dividends unless there was a substantial increase of business, if the efficiency of the plant was maintained. As to the possible reduction in dividends it was said: "It will be for the reason, as suggested in a former case, that the injudicious conversion of profits or supposed profits into stock imposes in the end a certain loss upon consumers or future holders."

On the subject of a fair price for gas, and the relation between this and the capital stock the commissioners said: "When gas reaches the consumer it is burdened with three obligations: First, its fair cost; second, a fair dividend on a reasonable amount of capital; and third, such excess as will give the company sufficient surplus to enable it to meet extraordinary accidents and conduct its business with the highest economy. The consumer is in duty bound to pay these charges. If he pays more and the company converts this excess into new capital, increasing it to a figure beyond the fair amount demanded by the business, the consumer is burdened with too high a price for the gas in the first instance and thereafter with a dividend charge upon his own contributions. A company which pursues this policy and to this extent fails to appreciate its obligations to its customers must sooner or later pay the penalty. The growth of the company's capital and its policy in reference thereto are recognized by this Board as facts which it is proper and necessary to consider in adjusting complaints by consumers."

Convention of the Ohio Electric Light Association.

The eleventh annual meeting of the Ohio Electric Light Association was held at Hotel Victory, Put-In Bay Island, August 16, 17 and 18. The place selected for the meeting is a delightful one for a summer convention. Being surrounded by so many miles of the waters of Lake Erie, it was cool and comfortable both in and out of the convention hall. There are plenty of opportunities for rest and recreation on the island, and many of the members were accompanied with ladies.

The convention was not without its entertainment features, and the ladies were especially well taken care of. Two afternoons the convention adjourned in time to go bathing. An informal dance was held Wednesday evening and also Thursday evening. Thursday evening an opportunity was given those members who wished it to go boat riding and later the Rejuvenated Sons of Jove held high carnival. Some handsome prizes in the way of electric heating devices were given by various friends of the association to ladies who won in the various bowling, tennis, croquet and card-playing contests.

Friday evening an illustrated lecture by W. D. A. Ryan, on "Illuminating Engineering" was a feature which attracted a large crowd. Mr. Ryan has given this lecture at several other conventions, but introduced a number of new features in this one, including the color effects of mercury-vapor lamps. After the lecture on Friday evening the banquet was held.

On Friday morning the following officers were elected for the ensuing year: President, Mr. F. E. Valentine, Piqua; vice-president, Mr. W. E. Russell, Massillon; secretary, Mr. D. L. Gaskill, Greenville. Advisory Committee—Mr. Samuel Scovil, Cleveland; Mr. J. H. Bendure, Lima; Mr. D. L. Gaskill, Greenville. Executive Committee—Mr. M. E. Turner, Cleveland; Mr. E. J. Bechtel, Toledo; Mr. M. C. Hull, Columbus; Mr. W. E. Miller, Mount Gilead; Mr. W. P. Engel, Defiance. Finance Committee—Mr. E. H. Beil, Youngstown; Mr. Fred. W. Bauer, Sandusky; Mr. W. E. Richards, Toledo. Publicity Committee—Mr. B. S. Young, Ada; Mr. J. H. Maxon, Gallipolis; Mr. C. C. Collins, Columbus.

The following new members of the association were elected: Active—Fremont Gas, Electric Light & Power Company, Fremont, Ohio, W. M. Adams, superintendent; Alliance Gas & Electric Company, Alliance, Ohio, D. W. Low, superintendent; The Ada Water, Heat, Light & Power Company, Ada, Ohio, B. S. Young, manager; Jamestown Electric Light Company, Jamestown, Ohio, S. A. Brown, superintendent; Columbus Public Service Company, W. H. Sharp, secretary. Associate—Library Bureau, T. E. Crawford, manager, Cleveland, Ohio; Allis-Chalmers Company, G. C. Colwell, district manager, Cincinnati, Ohio; American Circular Loom Company, T. H. Bibber, Chelsea, Mass.

The meeting at Put-in-Bay amply fulfilled both in attendance and in range and quality of the papers presented the prediction made last year upon the election of President Turner. A feature of the programme was that quite a number of the papers presented a collaboration of several authors. A larger number of new faces than usual were noticeable among the central station people, and the disproportion between these and the supply men was not as pronounced as usual. Taken altogether, the convention was the best in the history of the association.

Owing to the stormy weather on the lake just previous to the convention, which caused some irregularity in the boat service and consequently the arrival of members, the first session was not called to order Wednesday morning, August 15. By afternoon, however, the attendance was sufficient to open the first session of the convention. After some routine business, President M. E. Turner, of Cleveland, gave his address, in which he called attention to the present wave of sentiment going over the country in favor of rate regulation by State legislatures and city councils. He urged upon the members that, in view of the fact that such legislation was likely to come up, they should keep strict accounts of costs of supplying electric light and power service, in order that they may have reliable figures when the time comes that they are needed. He called attention to the improvements in lighting units made since the last convention.

The president's address was followed by the reading of a paper on "Waste Products of a Central Station," by J. A. Bendure, of Lima.

WASTE PRODUCTS OF A CENTRAL STATION.

The paper furnished a discussion of the advantages to the central station of going into the district heating business, but confined itself to steam heating. The ability to supply steam has often enabled a company to secure contacts for light and power which it would not otherwise have obtained. This then in turn increases the load and the profits from the electric end, and also increases the amount of exhaust steam that can be sold for heating. That the service is of special value and is popular wherever introduced is evidenced by its rapid growth and the many requests for extensions of mains and service connections with which every manager is favored. The author stated that the results of operation of heating systems by a large number of electric companies have demonstrated that it is reasonable to expect a revenue from the sale of steam at least equal to the cost of fuel used at the power plant for electric light and power, and extra for steam for heating purposes.

In the discussion of Mr. Bendure's paper, Mr. W. E. Russell, of Massillon, expressed disappointment that Mr. Bendure had not taken up also hot-water heating as well as exhaust steam heating from a central station. There was some further discussion, and Mr. Bendure, in closing, explained that hot-water heating had been omitted purposely because he had nothing favorable to say for it. He thought the rates for exhaust steam heating should be fixed at a point at which the company could make money even if it had to supply live steam.

H. L. Wallau, of Cleveland, read a paper on "The Use of Barriers in Alternating-Current Switchboard Construction for Potentials Below 4,000 Volts." This was followed by other papers as follows: "Mercury Arc Rectifiers," by P. D. Wagoner, Schenectady, N. Y.; "The Operation of Alternating Current Motors on the System of an Electric Light Plant of 1,000 kw Capacity or Less," by E. H. Beil, Youngstown, Ohio; "Recent Developments in Single-Phase, Alternating-Current Motors," by G. Percy Cole, St. Louis, Mo.; "Electric Motor Applications," by J. Henry Klinck, Pittsburg, Pa.; "Under What Conditions Has It Been Found Advantageous to Use Potential Regulators?" by W. E. Richards, Toledo, Ohio.

On account of the necessity of crowding a full day's programme into half a day, the discussion of all these papers, abstracts of which follow, was postponed until the next morning.

BARRIERS IN ALTERNATING-CURRENT SWITCHBOARDS.

The author gave an instructive discussion of the causes for excessive rises of potential in circuits containing both condensance and inductance and showed that many low-potential switchboards as now constructed are not capable of withstanding the abnormal conditions to which they may be subjected. The weakness is especially noticeable with reference to that portion of the boards, across which arcs may form when fuses blow due to a short-circuit on the line. It was suggested that boards which are defective in this respect may be remodeled by the use of barriers so installed that each polarity has a compartment by itself. Soapstone is an excellent material for barriers. It is very tough, can be sawed into very thin slabs, can be cut and drilled with perfect accuracy, and it is absolutely non-absorbent.

MERCURY-ARC RECTIFIERS.

The paper by Mr. Wagoner gave an account of the mercury-arc rectifier developed by the General Electric Company. After setting forth the theory of the apparatus, a detailed description with illustrations was given of a commercial outfit such as has been developed for charging automobile storage batteries.

ALTERNATING-CURRENT MOTORS ON THE SYSTEM OF AN ELECTRIC LIGHT PLANT OF 1,000 KW OR LESS CAPACITY.

The author cited the experience of a certain company with alternating-current motors. Originally the power service was 500-volt, direct current exclusively, but about six years ago the installation of alternating-current motors was begun. Since that time the company has been pushing the alternating-current business almost exclusively, except in elevator work, and at the present time it has about equal power loads on each service. On the alternating-current service motors ranging in capacity from ⅛ to 100 hp are connected, and very little disturbance to the lighting results from their operation. As a rule individual transformers are installed, the exceptions being in the smaller sized motors, say up to three horse-power, which are often connected directly with lighting installations. In many instances motors are started up under comparatively light loads, as in machine shops, laundries, etc., where the motors are connected to

the line shafting from which the machines are driven by countershafts. In other cases the full load is on from the start, a notable instance being that in which a 20-hp motor runs a roller coaster at one of the parks. The total capacity of the alternating-current motors now installed is approximately 700 hp, yet the total cost of repairs on the motors from the time of the first installation up to date has been less than $100.

SINGLE-PHASE MOTORS.

The paper outlined the constructional features and the operating characteristics of the Wagner single-phase induction-repulsion motor, the Schuler modified form of the induction-repulsion motor and the compensated series motor. The Schuler motor differs from the more usual Wagner machine in that, in addition to being provided with a commutator on which are placed brushes directly connected together in order to give to the machine the starting characteristics of the repulsion motor, it is supplied on the other end of the rotor with three collector rings connected into the secondary winding in three-phase relation. After the rotor has attained about one-half speed the polyphase resistance, which is connected to the secondary through the slip rings, is gradually decreased and finally short-circuited as the rotor runs up to full speed. The machine utilizes a combination of the torques of the single-phase induction motor and of the repulsion motor, and is stated to have exactly the torque characteristics necessary for elevator and hoist service. The compensated series alternating-current motor has the same characteristics as the direct-current series motor and is used chiefly for railway work. The author discusses the advantages of the single-phase circuits for distribution, which are in many cases sufficient to offset the increased cost of the single-phase motors in comparison with that of either the polyphase or direct-current machines.

ELECTRIC MOTOR APPLICATIONS.

The author enumerated some of the difficulties incident to the use of motors under various conditions and stated that a successful motor application can be made only when the characteristics of the driven machine are thoroughly known, and a motor of suitable design is used to operate it. The requirements of the machine must be supplied by the motor, not the reverse; for the machine is installed to do certain work, which is perfectly definite in character and which must not be changed under any circumstances. A direct-current motor working under load may have its speed varied by change in the voltage impressed on the armature terminals or by change in the field strength. By employing a three-wire, balanced-voltage generator it is possible to use 120 volts to supply the light circuits, and 120 and 240 volts for the motor circuits, the motor operating at the higher speeds on the 240-volt circuit, and at the lower speeds on the 120-volt circuits. By using a motor which has a two-to-one speed variation on a single-voltage circuit, the two-voltage arrangement gives a speed range of four-to-one.

The author described a type of motor having a speed range of four-to-one on a single voltage, which the Westinghouse Electric & Manufacturing Company has designed for use where it is not desired to install the three-wire system due to the limited lighting load. This type differs from the more usual one on account of the use of poles bolted to the frame midway between the main field poles. The auxiliary poles are used for the purpose of securing proper commutation, not only by the use of auxiliary fields, but also by such neutralization of the armature reaction as may be necessary to secure this result. The coils on the auxiliary poles are connected directly in series with the armature and consequently have at all times the armature current flowing through them, thus producing a magnetizing effect which can be made of any desired value for a given demagnetizing effect of the armature current.

VOLTAGE REGULATORS.

After outlining the necessity for a voltage regulator in systems supplying both motors and lamps with current from the same circuits, the author displayed several charts which served to show the excellent performance of a certain voltage regulator under severe service conditions. The regulator, which was used on an alternating-current system, consisted of a relay device which operated a boosting or lowering transformer which changed the e.m.f. by .6-volt steps throughout a range of 6 volts up or down. The e.m.f. of the auxiliary transformer was controlled by a switch which was given a step-by-step motion by means of a magnetic clutch driven from a line shaft. The direction of the motion was determined by the position of a relay voltmeter which was so connected to a potential transformer and a current transformer through a compensating device that a rise or fall of the e.m.f. consumed in the line actuated the armature of a dynamometer and established contact with the circuits of the magnetic clutches.

Thursday morning the president called for a discussion on papers read the previous afternoon. Mr. Leo A. Phillips, of Sanderson & Porter, in discussing the question of single-phase, alternating-current elevator motors, cited a case where a customer wanted to run an electric elevator on the end of a long, single-phase, alternating-current lighting circuit. It was feared that this would cause too much disturbance on the line, and the customer was induced to invest in a direct-current electric elevator and a storage battery from which to operate it. The storage battery was charged from a motor-generator set operated off the lighting circuit. It was sufficient to charge the battery once a week, this taking about eight hours during the daytime. The battery consisted of 58 cells, having a capacity of about 3,800 watt-hours. This was sufficient for 100 trips of the elevator. The elevator took 2¾ to 3 kw-hours per car mile.

Mr. H. L. Wallau spoke of one advantage of having single-phase motors on the lines as against polyphase motors. It would sometimes happen that one fuse would blow on a polyphase motor, unbalancing the phases and causing considerable disturbance as well as being detrimental to the motor, without, however, shutting down the motor entirely. Were it a single-phase motor, this could not occur, as the opening of a fuse would shut down the motor and the attention of those using it would be called to the matter.

Mr. Cole, in closing the discussion on his paper, thought the arrangement of motor-generator, storage battery and direct-current elevator motor was too complicated for most purposes. The present single-phase elevator motors would cause no disturbance on the line. In response to some questions which had been asked about organ blowing outfits, he spoke of a new apparatus for this purpose, which consisted simply of a fan driven by a motor, the whole being enclosed in a galvanized iron case to muffle the noise. The fan would deliver air in whatever quantities needed and there was no necessity for automatic regulating devices, as the motor and fan ran at constant speed and delivered the amount of air needed. Single-phase motors had proved their superiority over polyphase in irrigation pumping in California because of the fact that single-phase motors could be started from a distance. These irrigating pumps could be located at various points, perhaps a mile or more from a central switch house. By simply throwing the switch to any pump, the motor would start automatically, so that it was not necessary for the attendant to visit each pump house to start the motors, as was necessary with polyphase motors.

The next subject taken up was that on "Meter and Billing Records," which was introduced by short papers by Messrs. F. E. Valentine, Piqua; C. E. Inman, Warren; D. W. Low, Alliance, and Geo. Hayler, Joplin, Mo.

METER AND BILLING RECORDS.

Mr. Valentine contented himself with recommending the appointment of a committee to investigate and report on a system of central billing and recording. Mr. C. E. Inman described forms of a bill and electric meter card used by the Warren Water & Light Company. Mr. D. W. Low gave a number of forms used by the Alliance Gas & Electric Company, and Mr. George Hayler presented some of the best points found in record forms obtained from about 50 central stations located in the United States and Canada.

President Turner, in introducing the discussion of this subject, said that the records of the smaller companies throughout the State were in deplorable condition. He earnestly hoped that some simple system for the use of these companies could be worked out. The larger companies were already fairly well provided for. Nearly every company had a different system. The suggestions made in the paper by Mr. Low, although they appear somewhat complicated in the paper, were not so in reality and could easily be adopted by any small company.

A representative of the Library Bureau being called upon, stated the experience of his company in supplying card index record systems to electric lighting companies of Ohio, and said in all his company's experience there was only one case where two companies in the State used the same form, which well illustrated the great diversity of forms and methods. No company seemed to be satisfied to accept exactly those used by another company.

Then followed a paper by H. C. Ayres, Greenville, Ohio, entitled "Methods of Selling Current as Applied to Cities of 20,000 Inhabitants."

METHODS OF SELLING CURRENT AS APPLIED TO CITIES OF TWENTY THOUSAND INHABITANTS.

The author outlined the objections to the flat rate and to the straight meter rate and proposed a method of charging which eliminates the objections to each method. The customer is required to pay a certain small flat rate for each kilowatt of his installation, and in addition thereto he must pay a certain meter rate for all power consumed. The flat rate is determined by the fixed costs of the station, while the meter rate is determined by the running expenses. The advantages of this rate were stated to be as follows: It accurately represents the cost plus a profit in the case of each individual customer; it is a rate upon which yearly contracts can be made; it is a rate which will be attractive to the long-hour customer; it is free from objectionable meter or discount complications, and the income to the station and the bills to the customers will not vary as greatly as on a straight meter basis.

Mr. Valentine wished to know how customers liked the new system of charging outlined by Mr. Ayres. Mr. Ayres, later in the discussion, replied that the system was very well liked by customers and resulted in increased business. Mr. Wallau described the two-rate system in vogue in Cleveland, where stores and similar customers paid 12½ cents per kw-hour until an amount of power has been consumed equivalent to forty hours' use of the connected load per month. For all current used over this, the charge was 5 cents per kw-hour. In residences the actual connected load was not taken as a basis for figuring the rate, but a certain proportion of the connected load was figured according to definite rules. Mr. Ayres said that the system of charging he described in his paper had not been applied to resistances, as the high fixed charge would cause many small customers to use other illuminants.

Thursday's session was completed by the reading of the papers by Messrs. R. L. Johnston, of Akron, and Warren E. Russell, of Massillon, on "Methods Employed in Getting New Business and Retaining Old Business Where Natural Gas Competition Exists" and by the report of the committee on "Cost of Determinations." No session was held in the afternoon.

METHODS FOR OBTAINING NEW AND RETAINING OLD BUSINESS.

Mr. R. L. Johnston said that one of the strongest points in obtaining new business was to convince prospective consumers that they cannot afford to use gas with the accompanying risk and unpleasantness, at the same time setting forth the possibilities of the electric light for decoration and improving the appearance of the home and store. The best method for retaining old business is to make old customers satisfied with the quality of light, the reasonableness of the rates and the honesty and courteous treatment on the part of employees. Mr. Warren E. Russell gave interesting details of the manner in which the business of the Massillon central station had been built up. Advantage was taken of newspaper advertising and copies of an electrical periodical for popular reading were sent at intervals to prospective consumers, of whom a card catalogue is kept. He recommended sending out a circular letter monthly containing matter timely for the season, and if addressed to ladies, to dwell particularly on the cleanliness of electricity. As to wiring and fixtures, he considers it advisable to give any responsible householder all the time within reason to pay the bill, or include a certain percentage thereof in successive monthly bills for current. He believes that central stations are all coming to the free renewal of lamps, but if consumers pay for lamps they should be instructed as to when renewals are desirable. He recommended strongly that central station men should at once take up the matter of introducing electric flatirons, following these with other electric heating and cooking devices.

Friday morning the convention opened with the reading of a paper on "Line Construction," by B. L. Chase, and a paper by E. E. Noble, of Cleveland, on "Resuscitation from Electric Shocks."

LINE CONSTRUCTION.

The paper dealt with the constructional features of pole lines, especially those using wood poles, and discussed at length the proper location of the line and the material to be used for pins, cross arms, guys and for the poles. The author stated that the line proposition resolves itself down to a careful study of all contingencies, the installation of good material, thorough workmanship, rigid inspection and proper maintenance of every detail, as it is only by constant attention to these that the required service may be obtained. It is imperative that high-tension lines be placed above and entirely clear of all other wires. In general wood poles are preferable to iron poles for high-voltage transmission. Michigan and Idaho cedar make excellent poles. The poles should be set approximately 44 to the mile. Hard yellow pine serves best for cross arms and for ordinary construction will give good results, but for heavy corners and junction poles where the strain is great oak arms should be used. For high-tension lines all cross arms should be double, and a block securely bolted between the arms about eight inches from the end will materially add to their strength.

RESUSCITATION FROM ELECTRIC SHOCK.

The paper gives an account of some researches of two Cleveland physicians as to the probable cause of death from electric shock. The conclusions are that death from the passage of heavy current through the body is due either to temporary stoppage of the heart or contraction of the muscular fibres of the heart, whose function is to force the blood to the general circulating system and the lungs. There is also a fall of arterial blood pressure. The physicians claim that their experiments showed that unless a relatively large part of the current passing through the body traverses the heart, the shock would not necessarily prove fatal, and that by the prompt application of artificial respiration a patient may be restored. It was stated that an examination of the blood showed that electric currents "up to 2,300 volts" cause no chemical or other changes in the blood itself, nor any change in the tissue of the brain or spinal cord or other nerve structures. (This is contrary to the evidence of autopsies of criminals executed by the electric current, where the presence of numerous lesions were noted.) The physicians recommend a method of resuscitation which is already well known to electricians, and the author of the paper suggests the wearing by those exposed to high voltages of a light metallic gauze jacket next to the skin, or a system of metallic bracelets worn around the upper arms and connected by means of flexible conductors, and a belt of some similar material worn around the waist or some part of the body below the heart.

The main question brought up in the discussion of the paper on line construction was as to the minimum permissible size of wire for primary distributing circuits. Mr. Valentine said that many maintain that nothing less than No. 6 should be used on such circuits and would like to know what members of the association thought about it. The majority seemed to be using nothing smaller than No. 6, although one member reported using as small as No. 10 on unimportant branches. Another member had been using No. 8 on such branches. Mr. E. J. Bechtel, of Toledo, thought that in places of any importance No. 6 should be used for mechanical reasons. The discussion drifted back into the question of rates.

Mr. Ayres wanted a satisfactory introduction of the rate outlined in his paper. Mr. Bendure did not favor the fixed readiness-to-serve charge or the two-rate system in smaller towns. He thought there was an analogy between the electric light business and the drygoods or any other business. A merchant's profits would depend on the amount of business he did, and no merchant would think of trying to charge enough for his goods to cover fixed charges for a small volume of business. A merchant was expected to do a large enough business to cover these fixed charges. If he did not, it was his own fault. He had taken out 25 or 30 meters from the premises of small customers who objected to a 75-cent minimum bill, and he thought it would be hard to get them on any kind of a two-rate or readiness-to-serve system of charges.

Mr. Maxon, in refutation of this, gave his experience to show that the plan was good for small cities. In his town he had worked at a two-rate system of charging whereby each customer paid 12 cents per kw-hour for the first thirty hours' use of the maximum number of lights connected, after which the rate for further power consumption was 3½ cents per kw-hour. In answer to some things said in this discussion, which seemed to indicate that some of the members thought the readiness-to-serve rate of charging did not treat all customers alike, Secretary Gaskill explained that there was no discrimination between customers; that the same contracts were open to all. It had been found that the business men liked the system of a fixed charge plus a low kw-hour rate. Residences had not been put on this contract.

Mr. Ayres, in answer to a question, made a rough guess that about 50 per cent of the company's customers got a better rate as the result of the change to a fixed charge plus a low kw-hour form of contract. Mr. Bechtel said that there was not an analogy between electric lighting and the drygoods business as Mr. Bendure had indicated. The drygoods merchant's chief investment was in the stock he carried and his permanent investment was a small per cent of the total business. He thought the whole matter should be sifted down to a question of equity between consumers rather than a question of equity between the company and consumers, and this was a good way to explain the matter to consumers. The method of charging should be such as to distribute the costs fairly between different classes of consumers.

Mr. H. J. Mauger, of Schenectady, N. Y., spoke on the use of electric heating devices to increase load between peaks. To introduce such devices it was necessary that the first cost and the cost of maintenance and renewals on such devices be brought down so that they would be within the reach of ordinary customers. The indestructibility of a heating device also had in some cases much to do with the cost of operating it. For example, in the General Electric Company's egg boiler, eggs could be boiled by the use of but one tablespoonful of water, as it would not hurt the apparatus to run dry. By using this small amount of water and using the steam to cook the egg, the current need be used but a short time, whereas if enough water had to be boiled to cover the eggs, it would cost much more. It was a good plan to put out electric heating devices on trial, especially flatirons. Mr. Foote, of Jackson, Mich., had recently disposed of one hundred flat irons in this way, simply sending them out on trial, and all had been sold within a short time.

Mr. J. Kermode, of Cleveland, read his paper, entitled "Some Practical Suggestions on the Wiring of Residences and the Facilities given to Consumers for Increased Use of Electricity."

HOUSE WIRING.

The paper outlined the scheme of wiring for a modern eight-room house in order to bring out the fact that a moderate-sized house may be lighted in the most modern and satisfactory manner at an expense that will compare favorably with that for any other illuminant. For the parlor it is suggested that there be used several baseboard receptacles at widely separated points so as to allow the rearrangement of lamps without destroying the results to be obtained. In the combined reception room, library and living room there should be used a center chandelier, the lamps of which are arranged on two circuits and controlled from as many of the most convenient points as possible. The basement lamps should be of the high-low type and controlled by a switch at the head of the stairs, so that on entering the basement one would find in every room a light sufficient to show the way to any particular point where more light can readily be obtained. Sufficient outlets should be installed at various points in the house in order to permit of the use of curling irons, hot water heaters, heating pads, sewing machine motors, refrigerator motors and many other devices. The special arranging of the wires and the use of three-point or four-point switches make the installation somewhat more expensive than usual. It should be remembered, however, that the poor results which are often obtained from electric light and the high cost for the current used are very often due to the improper arrangement of the lamps and to the inadequate means for controlling them.

In the discussion of this paper Mr. W. E. Russell spoke of some very artistic wooden fixtures which had recently been placed on the market. Mr. Mauger called attention to the fact that rarely are provisions for heating circuits made in the wiring of a house, and that the amount of current required for many of these devices is so great that they cannot be run on ordinary lamp circuits. Mr. Young, of Ada, had found that the first cost of heating appliances was the greatest barrier to their introduction. Mr. Mauger agreed with Mr. Young that this had been the case. He hoped that it would not be so long.

Mr. J. R. Cravath, of the ELECTRICAL WORLD AND ENGINEER, said that he had devoted considerable attention to the class of work outlined by Mr. Kermode in his paper, and in most respects agreed with him as to the proper location and arrangements of lights in such a residence. The policy of looking carefully after the wiring of residences would bring good returns to any central station company. He made several suggestions as to various details of lighting arrangements in different rooms in modification of those mentioned by Mr. Kermode, including the use of a chandelier reading light as against an inefficient portable lamp on the table and the use of portable wall brackets in a bedroom, where the location of furniture was sometimes changed.

On Friday afternoon a paper on "Tests on Tantalum Lamps," by Prof. William Ambler, of Cleveland, was read by the secretary, the author not being present.

TESTS OF TANTALUM LAMPS.

Two lamps were tested, one with the clear and the other with the frosted bulb. The consumption of the former was 1.75 and of the latter 2.0 watts per mean horizontal candle power. On the basis of mean spherical candle power the consumption was 2.23 watts and 2.67 watts per candle power, respectively, the corresponding figures for a clear globe carbon filament lamp being 3.72 watts. The clear tantalum lamp was thus found to take 57 per cent. and the frosted lamp 64.5 per cent. as many watts per horizontal candle power as the carbon lamp, which latter had a consumption of 3.1 watts per horizontal candle power; and the tantalum with a clear bulb took 60 per cent, and the frosted lamp 72 per cent as many watts as the carbon lamp on the basis of spherical candle power. As compared with the carbon filament, it was found that it requires practically twice the change of voltage across the tantalum lamp to cause the same change in light. During a life of 1,000 hours both the tantalum lamp and the carbon lamp fell off 28 per cent. in candle power, while the increased consumption of current in the case of the tantalum lamp was 37 per cent., and in the case of the carbon lamp 33 per cent. These figures show that the energy taken by both the tantalum and the carbon lamp is practically constant during the life of the lamp. In Germany the cost of the tantalum lamp is 80 cents in barrel lots, as compared with about 16 cents for the carbon lamp. With these prices a calculation is given showing that there will be a saving by the use of the tantalum lamp only when the cost of energy is above 5 cents per kw-hour. This, however, does not include the value of burned-out lamps; allowing 50 per cent. of the original cost as the value of a burned-out lamp, there will be a saving of 35 per cent. in favor of the tantalum lamp with energy at 10 cents per kw-hour; with energy at 5 cents per kw-hour the saving amounts to 31.5 per cent., and at 3 cents to 13.5 per cent.

As all of the papers to be read at this session were on new high-efficiency lighting units, the discussion of this paper was deferred until others had been read. Mr. E. R. Roberts, of Pittsburg, Pa., then read his paper on "The Utility of the Nernst Lamp to the Central Station."

THE NERNST LAMP.

The first part of the paper discusses the subject under the heads of efficiency, color, assortment of units, power factor, high voltage and maintenance. The remainder of the paper treats of the specific advantages of the Nernst lamp in central station service, and gives the results of experience with it in a number of central stations. At present some 250 central stations use the Nernst lamp.

The paper of Mr. F. W. Willcox, of Harrison, N. J., on "High Efficiency, High Candle-Power Incandescent Lamps," was then read.

HIGH EFFICIENCY CARBON FILAMENT LAMPS.

The paper by Mr. Wilcox was devoted to the new type of carbon filament lamp which formed the subject of a paper read by Mr. John W. Howell at the recent A. I. E. E. Asheville meeting, which is rated at 2.5 watts per candle-power. The several forms of holophane reflectors used with this lamp were described and curves given illustrating the superiority of the new filament over the old carbon filament. It is stated that the new filament is obtained by applying an additional process to the present carbon filament, which includes heating in an electric furnace to a temperature of 3,000 to 3,700° C., this firing being performed both before and after treating. This results in producing an exceedingly pure form of carbon having considerably less specific resistance and greater density than the older filament. The process also changes the temperature coefficient from negative to positive. For this latter reason the term "metallized" has been employed to describe the new filament, although it contains no metal.

The discussion of the above three papers was then taken up.

Mr. W. D'A. Ryan, of Lynn, Mass., referring to Mr. Roberts' paper on the Nernst lamp, said that there was undoubtedly a field for a lighting unit intermediate between the incandescent and the

arc lamp. He thought, however, in discussing the Nernst lamp, it should be remembered that this lamp is essentially a reflector lamp, and in comparing it with the arc lamp it should be compared not to the arc with its natural distribution of light, but with the arc equipped with the proper reflector. Referring to the statement in the paper that the efficiency of the Nernst lamp was easily twice that of the incandescent, he cited tests which he had made on a single-glower Nernst lamp one year ago, which gave a consumption of 4.11 watts per mean spherical candle-power. Another test on a single-glower lamp made last March gave a consumption of 4.10 watts per mean spherical candle-power. A six-glower Nernst lamp gave a consumption of 3.88 watts per mean spherical candle-power. An incandescent lamp of the kind ordinarily rated as a 3.1-watt lamp (horizontal rating) gave a consumption of 3.76 watts per mean spherical candle-power. An incandescent lamp commonly known as a 3.5-watt lamp (horizontal rating) gave a consumption of 4.24 watts per mean spherical candle-power. The Nernst lamp, therefore, occupied a position midway between the 3.1-watt and the 3.5-watt incandescent lamp. He maintained that the fair way of comparing the efficiency of such illuminants is in watts per mean spherical candle-power. He verified Mr. Roberts' statement that one three-glower Nernst lamp is the equivalent of a Humphrey four-burner gas arc. He cited a test he had made with a Humphrey gas arc with the ordinary equipment of opal globe and reflector burning 14 cu. ft. of gas per hour with gas at a pressure equal to a 2-in. water column, equipped with Welsbach mantel. This combination had a mean spherical candle-power of 86.8. The maximum candle-power of 135 was about 10° above the horizontal. The mean spherical candle-power of the three-glower Nernst lamp was 71.6 with opal globe and 75.3 with sand-blasted globe. The mean lower hemispherical candle-power with the Humphrey gas burner was 97.5; the same for the three-glower Nernst lamp with opal globe was 97.3, and with the sand-blast globe 119.6.

Mr. Roberts, in closing the discussion, maintained that the mean lower hemispherical candle-power should be the practical standard used in comparing illuminants of this kind, as that was the important factor.

Mr. Willcox said that if the mean lower hemispherical candle-power is taken as the basis of comparison, arc and incandescent lamps must be equipped with reflectors before such comparisons are made, otherwise they are of no value. The new incandescent lighting unit described in his paper has a mean spherical candle-power consumption of 3.05 watts per candle. The lamp equipped with reflector gives a mean lower hemispherical candle-power for 2.5 watts. He said that although the new lamp has been made so far only in the larger sizes, it would probably be developed for the smaller sizes.

COST DETERMINATION.

The report of the committee submits a classification of costs under main heads as follows: Income or receipts, with 8 sub-heads; construction accounts, with 14 sub-heads; general expense accounts under the main heads of operating and maintenance, with 7 sub-divisions of the former and 8 sub-divisions of the latter; distribution expense accounts under the sub-heads of operating and maintenance, with 6 sub-divisions of the former and 8 sub-divisions of the latter; general expense accounts, with 11 sub-heads. The paper concludes with an illustration of the application of the system to a specific case.

The closing event of the convention was the lecture on "Illuminating Engineering," delivered on Friday evening by Mr. W. D'A. Ryan, of the General Electric Company. The hall was crowded, with many ladies present, who paid close attention to the lecture and accompanying illustrations. The lecture was a general treatment of the subject of light and color, with some reference to illuminating engineering, the various points being illustrated by special apparatus designed expressly for the purpose. A number of interesting and instructive color experiments were shown, which had a practical bearing on the lighting of large areas, such as stores and the like. At the conclusion of the lecture a "pari-chromoscope." or color booth, was exhibited, which showed the effect of the incandescent, arc, Nernst and mercury lights upon various textile fabrics exposed to these various lights, and the change in color of certain materials when transferred from one booth to another. Mr. Ryan dwelt on the improvement possible in arc lighting by the use of a light balancing selective diffuser, giving a considerable increase in the efficiency on the store counter level when arc lights are used through producing a perfectly steady and white light.

LETTER TO THE EDITORS.

The Patent Law Situation.

To the Editors of Electrical World and Engineer:

SIRS:—For the last 15 years articles have appeared at intervals in the technical press calling attention to the inadequate method of obtaining justice in disputes based upon patents. The last one, by the well-known patent attorney, Mr. Edw. P. Thompson, of New York,* clearly shows some shortcomings of the present method, but he puts matters rather mildly when he says: "As the judge in court is only a legal man, a suit at patent law is nothing more than a burlesque or comedy in the eyes of a technical man."

Many a man who has the experience of wrong decisions, as well as others who only know about them, charge the judge with being interested or bribed. I, myself, firmly believe in the fairness and strength of character of the judges in American courts, in spite of the many wrong decisions by them and the resulting hardship to many law-abiding citizens, but I wish to point out that the well-known inefficiency of courts in properly dealing with technical cases lowers the prestige of these courts considerably, and may be a direct cause for seeming and actual disregard of laws and ordinances by many.

The concentration of power in large corporations and trusts has also become a feature of the electrical industry, and oppressive methods for removing competition are but natural consequences. Patents are singularly well adapted to further this end, for under the pretext of the desire to enforce laws and rights, suits can be brought which would make manufacturing unprofitable to enterprises of moderate capitalization. Well planned attacks by attorneys trained for years in such practice, testimony from experts having flexible consciences, and the inexperience of judges in technical matters are three formidable factors for systematically practicing anarchy under the guise of law.

Some ten years ago or more steps were taken by legal profession to overcome the greatest wrongs by presenting a bill before Congress for the creation of a "Court of Patent Appeal." Nothing has been heard of this so far. My inquiry at that time into the probable effectiveness of such an organization resulted in statements which may be summarized somewhat as follows: "It is not all that may be desired, but it is the best we can get at present."

In other words, if a firm has been persecuted for several years and has paid thousands of dollars for legal defence, it should be possible to appeal to a court where the subject may be expected to be reasonably well understood and which would enable the weaker party to get justice and not be crushed out of existence. Time has passed for calling atention to facts; action is required by those desiring a remedy from the present state.

Patents are interstate grants and rights and the Federal Government can be appealed to for the desired change. Below is outlined a plan which it is confidently believed will lead to the desired results if every manufacturer of electrical, mechanical or other devices protected by patents, and every inventor, lawyer or other person interested will respond promptly. It is not believed that a Patent Court of Appeals will give the desired relief and the plan here submitted consists in part in ascertaining from as many representative firms of various industries, lawyers, patent attorneys, judges and inventors, which system may best remedy for existing shortcomings. The plan consists in the execution of the following steps:

1. Everybody interested is requested to examine carefully the various remedies or suggestions submitted at the end of this letter and to select from them the form which he considers best adapted to give the greatest amount of justice at the least expense, or if none of these forms suit, to suggest another way, accompanying the suggestion with a brief explanation. The answer should not be formulated in its final shape before the subject has had four weeks' consideration.

2. The present communication should be shown by inventors, manufacturers and engineers to others, especially manufacturers in other branches, and to patent attorneys and lawyers in their locality, for consideration, judgment and reply in accordance with clause 1.

3. The answers, which shall be considered strictly confidential,

* Electrical World and Engineer, Vol. 45, No. 13, Page 634.

are to be addressed to and collected by the editors of the ELECTRICAL WORLD AND ENGINEER and the *American Electrician*, such communications to be marked "Patent Law Reform."

4. The correspondence thus collected is to be forwarded to the Bureau of Commerce and Labor, or as suggested by an eminent jurist of St. Louis, if the correspondence is voluminous, and representative firms, engineers and attorneys recognize the importance of this matter, a memorial may be prepared and handed, with the communications, by a Congressman or the chairman of the Ways and Means Committee, to the President of the United States, who, according to his judgment, may turn the matter over to the proper department or make suitable recommendations to Congress for its attention and action.

5. In this latter case instructions to Congressmen and Senators by all interested may be desirable, explaining the purpose and results hoped for and asking for their co-operation and support of a bill that will bring about the desired results.

For consideration and selection, the following modifications of the present practice are respectfully submitted in all such legal cases involving patents.

1. The court shall call to its assistance in ruling and deciding, in a technical suit, an expert uninfluenced by either complainant or defendant.

2. A court shall obtain an expert from the Patent Office selected by the Commissioner of Patents or head of the department in which the patent is classified.

3. A court shall call to its assistance an expert from the Patent office and another practical or theoretical expert as the case at hand may dictate.

4. The judge shall associate with himself a practical and theoretical expert. State or Federal laws to indicate who shall pay for these services.

5. The creation of a lower and upper Patent Office Court as a separate department of the Patent Office. In such a case the complainant informs the lower court that X is infringing his patent No. ——— and presents his side; in due course X is notified by the lower court (as at present in a case of interference) to present his case.

a. If considered necessary, lower court official hears cases in different sections of the country at fixed seasons of the year.

b. All matters not involving patents or technical matters to be referred to a local court for decision.

6. Suits involving patents to be handled as heretofore, but all testimony to be sent to Washington, for an opinion and assistance from a commissioner, examiner or officer of a department created for this purpose as a separate branch of the Patent Office and manned from the corps of examiners and commissioners of the different departments. Such official to be present at the final hearing of the case and to assist the court in judging the merits of each side.

7. A court of final appeal to be permanently located in Washington and to be formed by the heads of departments or legal lights of the profession.

The opportunity is now open to the individual reader to enter these primaries and give his decisive vote for reform, better patent protection and court ruling. The earnest and vigorous support of everyone interested is desired.

ST. LOUIS, MO. LUDWIG GUTMANN.

DIGEST OF CURRENT ELECTRICAL LITERATURE

DYNAMOS, MOTORS AND TRANSFORMERS.

Testing Alternators.—PARSHALL.—A communication referring to a method which is on the Hopkinson principle, two similar alternators being necessary. These are mechanically connected by a special coupling which allows the two armatures to be displaced by any desired angle. He conducted the tests with two 385-kw, 2,200-volt alternators running at 300 r.p.m. The results of the tests show that when two similar machines are equally excited the phase of current and e.m.f. obtaining in the circuit corresponds with close approximation to that of an alternator running on a non-inductive load. The set was belt-driven and a dynamometer was employed to measure the torque applied. Besides determining the efficiency of the alternators at different loads, the author obtained quantitative results with regard to the armaure reaction and its effects upon the field magnets. The method was also applied for resolving the total losses into their components.—Lond. *Elec.*, July 21. The paper is described in full in the *Jour.* of the British Institute of Civil Engineers, Vol. 130, p. 247.

Iron Loss.—LYDALL.—An account of experiments in which the author investigated how far the Steinmetz hysteresis law holds good with high densities, such as 20,000 c.g.s. lines per square centimeter, a value which is reached in almost all direct-current generators at the roots of the teeth on the armature. From his experiments it appears that it is fairly safe to assume for practical purposes that the hysteresis loss varies as the 1.6th power of the induction even up to the highest values. At higher inductions (above about 18,000) there is, however, an additional eddy-current loss which depends on the saturation. To explain it he considers the possibility of eddy currents in the end plates of the armature caused by a magnetic flux entering them from the poles. The author gives an explanation based on this idea.—Lond. *Elec. Rev.*, June 23 and July 7.

Voltage Drop of Transformers.—HAHNAMANN.—An illustrated description of a simple graphical method for determining the voltage drop of transformers.—*Elek. Zeit.*, July 27.

LIGHTS AND LIGHTING.

Small Incandescent Lamp.—LAFFARGUE.—Some notes on a new small incandescent lamp, the filament being made from an alloy—zirconium being one component. The lamps require only small e.m.f's, such as two or four volts, so that only one or two storage cells are necessary. Some data are given on a 2-cp lamp which at four volts consumed 0.46 amp. (this gives a specific power consumption of 0.92 watt per cp). This is compared with an ordinary incandescent lamp of 2 cp, which at 8 volts consumes 0.95 amp., corresponding to a power consumption of 3.8 watts per cp. While this new lamp is more expensive in first cost, the cost of operation is much less on account of the higher efficiency.—*La Nature*, July 29.

Train Lighting.—An illustrated description of the Leitner-Lucas system of train lighting which has already been mentioned in the Digest. Some remarks on the Rosenberg system by Dalzeel and Rosenberg are published in the correspondence columns of the same issue.—Lond. *Elec.*, July 7.

Electrochemistry of the Metallic Arc.—LADOFF.—The first part of a summary reviewing the researches of various investigators on the metallic arc.—*Electrochem. and Met. Ind.*, August.

POWER.

Electric Driving of Reversing Rolling Mills.—Some illustrated notes on the Ilgner system. The energy-storing fly-wheel on the motor-generator set from which the individual motors of the rolling mills are supplied with current should consist of one steel casting so as to be able to withstand the severe stress to which it is subjected. Its diameter is as a rule limited by considerations of transport. Its maximum peripheral speed should not be more than 295 ft. per second. A 42-ton fly-wheel with a rim weighing about 34 tons and rotating at the maximum speed mentioned is able to give out 7,500 hp for nearly 5 seconds for a 15 per cent reduction in speed. This

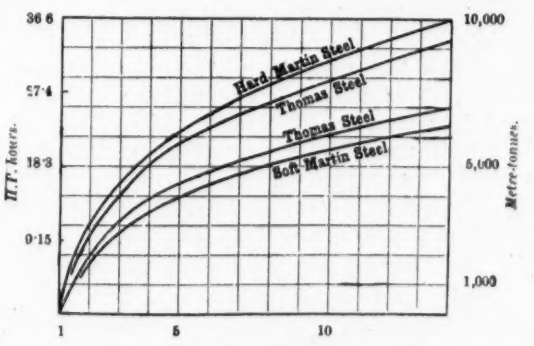


FIG. I.

is much more than is needed to pass a bloom of about 2.5 tons once through the rolls. Tests have been made by Koettgen on the work consumed in rolling with different steels. Fig. 1 embodies the results of these tests, and shows the work done in lengthening a bloom weighing 4,900 pounds, and measuring at the outset 5 ft. 7 in. by 16½ by 16½ in. These curves enable the energy to be calculated for any kind of steel and iron works, the operating conditions of which are known.—Lond. *Elec.*, July 27.

Direct-Connected Motors in Repair Shops.—An editorial pointing out that the usual practice of street railway repair shops is to group drive the repair shop machinery by tramway motors which have passed their period of usefulness for car service under the severe conditions of the present day. It is thought, however, that the cost of operation could in many cases be lowered by the substitution of modern equipment. In very small repair shops conditions will seldom justify the extended use of direct-driven tools. But as the size of repair shops increases the opportunity to apply individual motors to heavy machines doing intermittent work or operating with a wide range of speed variation, grows greater until in the highly specialized shops of large systems a broad field of usefulness is found for both kinds of service. Small machines like grinders, hack saws, medium size lathes and shapers constantly used are generally better driven in groups, but in the heavier work with high-speed steels and variable cuts the individual motor deserves wider recognition.—*St. R'y Jour.*, August 12.

Electric Drive at a Powder Mill.—A description of the electric installation of a new powder mill in Morrow, Ohio. Induction motors are used, and to prevent explosions all electric wires of all the motors except in two cases are placed outside the buildings and the power is carried in by a shaft projecting through the wall.—*Eng'ing Record*, August 12.

Tidal Power.—SAUNDERS.—A discussion of the utilization of tidal power with numerous illustrations. The author endeavors to show that the problem is "not such a fantasy as many people imagine."—*Eng'ing Review*, August.

Steam Turbines and Reciprocating Engines.—GRAY.—A comparative analysis of the performances of steam turbines and reciprocating engines in four steamers of the Midland Railway Company. The great superiority of the turbine steamers is shown in detail. The difference of the initial cost is not great and amounted to only 1½ per cent of the total cost of hull and machine.—Lond. *Eng'ing*, August 4.

Diesel Engine.—BEHREND.—An illustrated discussion of the usefulness of the Diesel engine in electric stations, especially in stations of small and medium size.—*Elek. u. Polyt. Run.*, July 15.

Spinning Mills.—Some illustrated notes on the use of electric motors in spinning mills.—*La Nature*, July 29.

Single-Phase Transmission.—NUNN.—Illustrated notes on the Telluride plant.—*Elec. Jour.*, August.

TRACTION.

Regenerative Control of Tramway Motors.—Some notes on results obtained on 41 cars in Birmingham with the Raworth regenerating system.—Lond. *Elec.*, July 21. In the Johnson-Lundell regenerative tramway motor the aim is not only to save by regenerating current when the car descends an incline or is brought to rest, but also to avoid practically all starting resistances. To this end the armatures are provided with a double winding and with two commutators, and at starting the rush of current is kept within reasonable limits by connecting all four armature windings in series. The field magnets are provided with a number of coils which may be connected in groups in series, or connected some in shunt and some in series, to form a compound winding, by an auxiliary controller or field changer. When the car is accelerating or running normally the motors are connected as series motors pure and simple. Speed regulation is obtained chiefly by connecting the motor armatures in various ways across the supply. When the motorman wishes to stop or to slow down, he presses with his thumb a button on the top of the controller handle; this causes the motors to be converted to compound-wound machines. By moving the handle simultaneously to one or the other of the notches the driver has it in his power to regulate the degree of braking.—Lond. *Elec.*, August 4.

Petrol Omnibuses versus Electric Tramcars.—LUNTLEY.—A paper read before the British Municipal Tramways Association. The cost of operation of omnibuses is higher than that of tramways; one of the principal items of the expense of the former appears to be the maintenance and renewal of tires. The earning capacity per mile is less with an omnibus than with a tramway. The following cost of operation of omnibuses for 36 passengers is given, the figures being the cost per omnibus mile. The operating charges (petrol, wages, etc.), 9.352 cents; maintenance and renewals, 5.850 cents; general cost, 0.6 cent; interest and depreciation, 4.6 cents; total cost per omnibus mile, 20.402 cents.—Lond. *Elec.*, July 7.

Seebach-Wettingen Line.—HERZOG.—Some notes on electric traction on the Seebach-Wettingen line by means of single-phase current at 15,000 volts. The author discusses especially three systems of suspension of the trolley wire which have been experimented with.—*L'Eclairage Elec.*, July 29.

London.—The voluminous report of the Royal Commission on London traffic with a map showing the existing and the proposed tramways.—Lond. *Elec.*, July 21.

Tramway Exhibition.—A long illustrated description of exhibits at a recent tramway and railway exhibition in London.—Lond. *Elec.*, July 7, 14.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Combined Lighting and Traction Stations.—RIDER.—A paper read before the British Municipal Tramways Association. The author speaks especially on the financial results obtained with combined stations and on the advantages of supply from such stations. In his opinion there should be one electricity supply department for a town and it should provide all energy required and for whatever purpose. It should feed into the overhead wires of the tramway department just as into the wiring of any building, and, as a result of this it should provide all underground feeder and distributing cables. By adopting the maximum demand system of charging, all energy can be fairly supplied on the same terms, whether to tramways, to public lighting or to power users. But the initial price should be kept high and for as short a period as possible, while the second price should be kept as low as it is possible to make it. All classes of consumers will then be charged at rates in accordance with their use of the supply and the "long hour" demand of the tramways will result in a very low actual price per unit. With a proper system of charging, current can be supplied cheaper from a combined station than from a separate station. The paper was discussed at length.—Lond. *Elec.*, July 7.

Polyphase Motors on Single-Phase Circuits.—GARCELON.—Some notes on methods of starting and running polyphase motors with cage-wound secondaries on single-phase circuits. Fig. 2 shows a

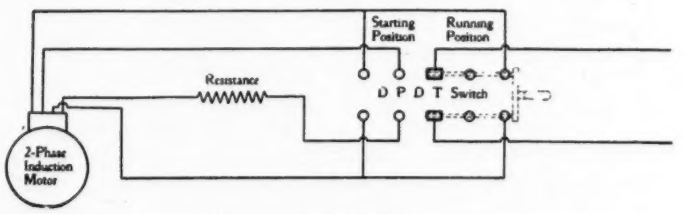


FIG. 2.

method of connecting a two-phase motor and resistance through a double-throw switch. Curves are given by the author showing results of a test of this arrangement. These show that the starting torque depends on the value of the resistance in series with the starting phase. The torque increases as the resistance is decreased

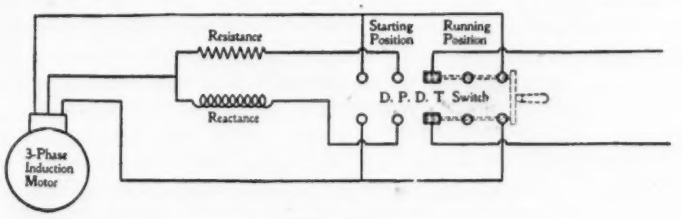


FIG. 3.

until a maximum is reached, when, if the resistance is still further decreased, the torque falls off very rapidly. This is explained and the vector diagram of the arrangement is given. For a given motor the value of the resistance to be used is best determined by a simple test. Place a non-inductive resistance (water rheostat) in series with one phase and adjust it until a desirable torque is obtained.

Then measure the volts across the rheostat and the current in the starting circuit. The volts divided by amperes will give the ohms required. Fig. 3 shows a three-phase motor connected for operation on a single-phase circuit. In this case both inductance and resistance are used for starting. The current in the different circuits is split as before, but here there are three currents, each of which is out of phase with the other two. This motor could be started with either the resistance or the inductance alone. Resistance will give better results than inductance because the motor winding itself is almost entirely inductive. The author thinks that in general the most satisfactory method of splitting the phase is the use of a simple non-inductive resistance which may readily be improvised.—*Elec. Jour.*, August.

Sub-Station.—An illustrated description of the Acton sub-station, which is supplied with two-phase current at 10,000 volts and 60 periods per second, and converts them into direct current by means of motor-generators. The motors are induction machines. The construction of the sets is described and illustrated.—Lond. *Elec. Rev.*, July 7 and July 14.

Three-Wire Distribution in Workshops.—BIRKETT.—An article advocating the more extended use of three-wire distribution in factories and workshops and describing an installation of this kind in a large engineering works.—Lond. *Elec.*, July 21.

Switchboards.—PECK.—In a continuation of his illustrated serial on modern practice in switchboard design, the author describes hand-controlled, high-tension switchboards.—*Elec. Jour.*, August.

Controller.—An illustrated description of a new two-voltage or series-parallel controller for electric motors, designed to obtain a long range of speed by supplying a motor with two voltages by the three-wire system or for use with the series-parallel machines.—Lond. *Elec.*, July 7.

ELECTROPHYSICS AND MAGNETISM.

Definitions.—BREISIG.—A paper read before the Berlin Electrical Society suggesting some definitions of the electric properties (especially self-induction and capacity) of conductors, especially systems comprising two or more wires. The paper led to a very animated discussion, and the subject is to be further discussed by a special committee.—*Elek. Zeit.*, July 6.

Wattless Current.—A long article giving without mathematics and without analogies an explanation of what is meant by a wattless current.—Lond. *Eng'ing*, August 4.

Electrons.—LORENTZ.—The first part of a French translation of his German paper on the results and problems of the theory of electrons.—*L'Eclairage Elec.*, July 29.

ELECTROCHEMISTRY AND BATTERIES.

Niagara Falls.—Some notes on the development of electrochemical industries at Niagara Falls during the first decade of their existence. The Pittsburg Reduction Company started operation August 26, 1895, while on October 19 of the same year the current was turned on at the plant of the Carborundum Company.—*Electrochem. and Met. Ind.*, August.

Efficiency of Furnaces.—RICHARDS.—In a continutaion of his serial on metallurgical furnaces the author discusses in detail the calculation of the efficiency of various metallurgical furnace processes and points out that it is important to know the absolute (not the relative only) figure of the efficiency. The author then gives a summary of thermochemical data for alloys.—*Electrochem. and Met. Ind.*, August.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Electrical Instruments.—TAYLOR.—An article on the handling of electrical instruments in relation to their accuracy. The author first discusses the influence of stray magnetic fields. There are more opportunities for errors of this kind in measuring large currents than in measuring small ones. Instruments containing permanent magnets should be placed at a safe distance from each other, from two to three feet apart. Alternating and direct-current ammeters and wattmeters made for large currents are likely to have only a turn or two in the coils carrying the main currents. It is then a matter of importance in connecting them, to bring the leads to them in such a way that they do not form a loop which can set up a magnetic field aiding or opposing that of the instrument winding. The best way of doing this is to keep them very close together, preferably twisted together for some distance away from the meter. The author then discusses the correction required for energy losses in the instrument itself. Mutual induction between the shunt and series coils of wattmeters is often a more important item than the self-induction of the shunt coil in causing errors in measurements at high frequencies or low power factors. A rough check showing whether the mutual inductance in a wattmeter is excessive can be made by short-circuiting the series coil while the shunt is connected to the line at normal voltage at a frequency of 60 cycles or higher. If the movable element is freely pivoted and does not show any deflection, the mutual induction between the coils is probably not high enough to cause any serious error. The author then discusses general precautions necessary in the handling of instruments and the usual troubles caused by an overload of one kind or another. Finally zero errors are discussed. To add the zero error algebraically to the observed reading seldom gives exactly correct results. Sometimes it introduces an error greater than if no correction had been attempted. In general it is safer to reset the zero reading or to assume that the zero error has not changed the calibration at the upper part of the scale than to attempt to correct for it. Indiscriminate resetting of the zero reading by means of the usual spring adjustment is not to be recommended. If the error has been caused by bending the index it is better to bend it back again, even though the displacement was slight.—*Elec. Jour.*, August.

Damping the Oscillations of Galvanometer Needle.—EINTHOVEN.—A description of a method in which, as indicated in Fig. 4, a con-

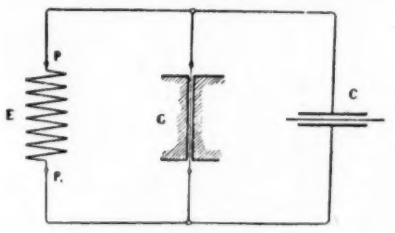


FIG. 4.

denser, C, is connected in parallel with the galvanometer, G. To explain the action of the condenser the author first assumes the mass of the movable portion of the galvanometer to be negligible and also neglects any damping effect. If then the capacity of the condenser is zero the sudden application of a potential difference between P and P_1 will cause the galvanometer to assume suddenly the corresponding condition of equilibrium. If, however, a certain amount of capacity is present, a certain time will be required for the needle to get into its new position. The mirror image (or the quartz thread) will move then in the same way as a condenser is charged or discharged. The author shows mathematically that by adjusting the capacity and the resistance it is possible to adjust the damping effect at will. The condenser method can probably be used only with measuring instruments having a large internal resistance and a short period of oscillation. It may be used to advantage with the quartz-fibre galvanometer if one wants to measure variations of current of very short duration. For this purpose a very short and tightly stretched quartz thread should be used.—*Elek. Zeit.*, July 27; from *Ann. d. Phys.*, Vol. 16, 1905, p. 20.

Photometric Lamps.—WILD AND FLEMING.—Several communications. Wild says that the method of ageing is of great importance. It is not sufficient simply to age for any given number of hours, but the ageing should be stopped at that point at which the rate of change of candle-power is a minimum when taken over an extended period. A standard lamp selected and aged on these lines can be relied upon to change by not more than one per cent with 100 hours of use. Fleming recommends large bulbs; a preliminary ageing of the filament by running it in a temporary bulb is essential and such ageing should be conducted so as to bring the lamp into the condition in which the candle-power becomes constant for a short time; in other words, until the lamp reaches the flat part of the candle-power life curve. After that the filament should be transferred to the second large cylindrical bulb for final exhaustion.—Lond. *Elec.*, July 7, 14, 21.

Wattmeter Correcting Factors.—EDGECUMBE, WILSON, DRYSDALE.—Several communications with respect to this matter.—Lond. *Elec.*, July 7, 14, 21.

Tesla Transformers.—DRUDE.—A paper giving formulas for the rational construction of Tesla transformers.—*Ann. d. Phys.*, Vol. 16, 1905.

Factory Testing.—Workman.—In a continuation of his illustrated serial on factory testing of electrical machinery he deals with the determination of the power curves of induction motors.—*Elec. Jour.*, August.

Electric Oscillations.—Gehrcke.—An illustrated account of experiments made in the German Reichsanstalt on the measurement of the wave length of electric oscillations such as used in wireless telegraphy. The Slaby multiplication rod is recommended as a working standard for calibrating other instruments for measuring wave lengths. For calibration, Lecher's arrangement of double wires is used since the use of a single wire leads to errors.—*Elek. Zeit.*, July 27.

Telegraphy, Telephony and Signals.

Wireless Telegraphy in One Direction.—Artom.—"Righi has shown analytically that a combination of two electric oscillations, rectangular to each other and having equal intensity, equal frequency and a phase difference of ¼ wave length, will lead to the production of oscillations with rotating polarization. If the theoretical requirements are strictly fulfilled there will result circularly

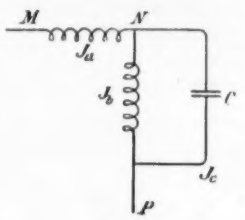


FIG. 5.

polarized waves in a certain direction. This direction is the axle of symmetry perpendicular to the plane in which the oscillations take place." Artom has endeavored to utilize this arrangement for wireless telegraphy. If in Fig. 5 the same alternating current passes through $M\,N$ and $N\,P$ the arrangement may be made so that the currents Ja and Jb have the same intensity, but are displaced in phase by 90°, by shunting $N\,P$ by a condenser, C, of proper capacity. If

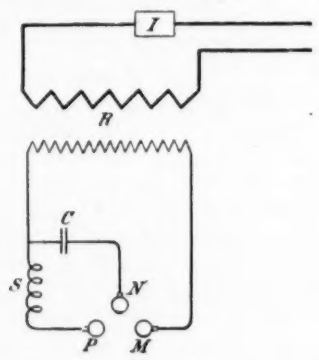


FIG. 6.

r_2 is the ohmic resistance and L_2 the self-induction of $N\,P$ the two conditions to be fulfilled are

$$2\,\pi\,n\,L_2 = r_2 \quad \text{and} \quad 4\,\pi^2\,n^2\,L_2\,C = 1,$$

where n is the frequency. If now in Fig. 6 $M\,N\,P$ are the three

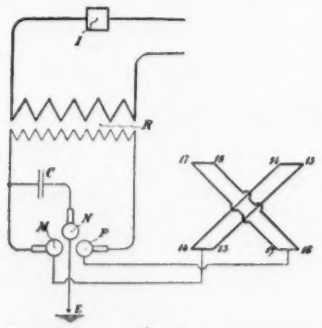


FIG. 7.

poles of air-gaps placed at the three corners of a right-angle triangle with equal sides, $N\,P$ and $M\,N$, the self-induction, S, and the capacity, C, may be chosen so that the above two conditions are fulfilled. We then get two discharges of equal amplitude, of which one ($M\,N$) may be considered to result from a primary oscillating circuit, the other ($N\,P$) from a resonator. In practice the arrangement is that shown in Fig. 7, where the poles, M and P, are connected to two systems of aerial wires of equal length, but perpendicular to each other. "These systems of wires are then the starting point of oscillations of equal amplitude with a phase difference equal to ¼ wave length. The combination of both oscillations produces electromagnetic waves with rotating polarization which are propagated in the direction of the axle of symmetry perpendicular to the plane through the two antennas." The main feature of the system is that the waves are sent in a special direction whereby energy is saved and messages cannot be intercepted by receivers outside of the direction of the wave. Some notes are given on experiments made by the Italian Navy in 1903 and 1904 with this system. In these experiments it was shown that the waves are really transmitted in a straight direction. With this system Artom claims that the vertical wires do not need to have the great length required with other systems. Thus between Monte-Mario and Maddalena, a distance of 160 miles, messages were transmitted successfully with wires which were only about 30 meters (98 ft.) over the ground.—*Elek. Zeit.*, August 3.

Wireless Telegraphy.—Sachs.—An account of experiments on the rôle which the earth plays in wireless telegraphy. He concludes that the earth is not the seat of the electric waves, but on the contrary the earth and all conductors connected with it have a more or less unfavorable effect on the transmission of the waves. The conditions may be somewhat different in ocean telegraphy.—*Dingler's Polyt. Jour.*, August 5.

Miscellaneous.

Export Trade.—Digby.—A very full discussion of the engineering exports of Great Britain, Germany and the United States during the last five years, with an analysis of the relative importance of these three great manufacturing nations in each of the most valuable markets for export trade. The results are illustrated graphically by diagrams.—*Eng'ing Mag.*, June, July, August.

Laboratory.—An illustrated description of the new electrical engineering laboratories at the Liverpool University.—Lond. *Elec.*, July 7.

BOOK REVIEWS.

Mathematische Einführung in die Elektronentheorie. (Mathematical Introduction to the Theory of Electrons.) By A. H. Bucherer. Leipzig: B. G. Teubner. Cloth, 148 pages, 14 illustrations.

It is only a little while since electrons were first conceived of, and now we have a preliminary mathematical theory of their behavior and actions. This volume is devoted to that study. One of the principal hypotheses of the modern theory of electrons is that the ether is stationary in matter and that matter is permeated by the ether in such a manner that the ether is not displaced by the displacement of matter. This view is, to a certain extent, opposed to that developed in Maxwell's original theory.

The book is written in vector algebra and is very condensed in its expression. The ground in common between optics and electron movements is carefully investigated. By the advanced mathematical student interested in optics and in electricity, the treatise will be found timely and instructive.

Traité Théorique et Pratique D'Électricité. (Theoretical and Practical Treatise of Electricity.) By H. Pécheux. Paris: Library Ch. Delgrave. 720 pages, 800 illustrations. Price, 17 francs.

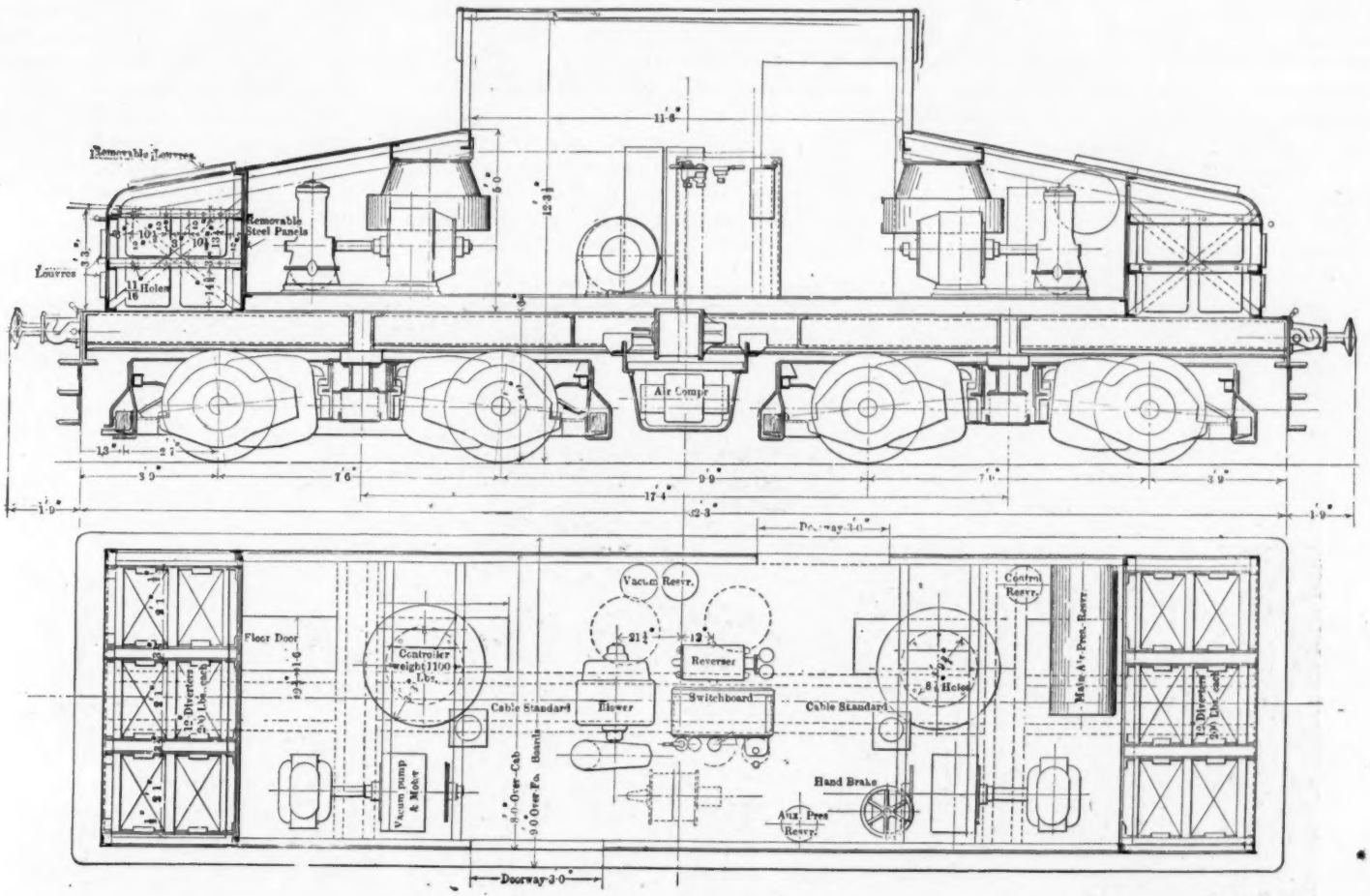
The author of this work is the professor of physics and chemistry at the École Nationale d'Arts et Métiers d'Aix. The work itself represents in large measure the course of lectures on the subject of Electricity given in that institution. The treatment is that of a textbook on applied electricity from the standpoint of the physicist. The magnetic circuit is particularly well treated, and the development in this direction is alone sufficient to make the book noteworthy.

The style is clear and practical, the mathematics in general not difficult, and numerous arithmetical examples occur throughout the book. The first section is devoted to electrostatics, the second to electrodynamics, and the third to electrical applications. As a textbook for the use of high school students the book is excellently designed.

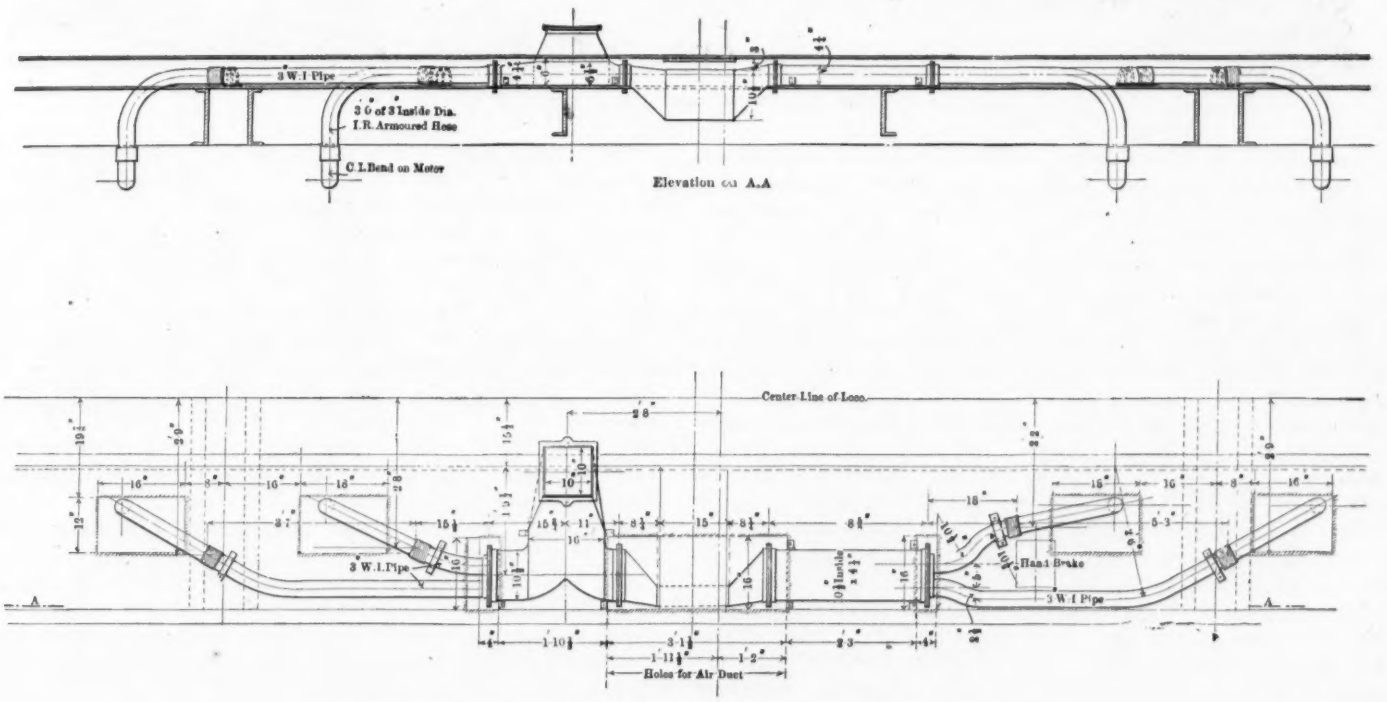
New Westinghouse Electric Locomotive.

The accompanying illustrations show a type of electric locomotive made by the British Westinghouse Company for the London Metropolitan Railway, of which ten are to be supplied for heavy hauling service. The first locomotive has been already delivered and the others will soon follow.

The locomotive equipment consists of four motors, the normal ratings of which are 200 hp each; but by aid of the forced ventilation, which is supplied by an air-blowing set, the motors are rendered capable of developing 250 hp each with perfect safety. The locomotive is also equipped with both the Westinghouse automatic air brake and vacuum brake, and each is coupled to the foundation brake gear in such a way that either may be manipulated and caused to apply the brakes without making any changes whatsoever in the connections.



FIGS. 1 AND 2.—SECTIONAL VIEWS OF ELECTRIC LOCOMOTIVE.


3 W.I Pipe
3 0 of 3 Inside Dia. I.R. Armoured Hose
C.I. Bend on Motor
Elevation on A.A
Center Line of Loco.
Hand Brake
Holes for Air Duct

FIGS. 3 AND 4.—SECTIONAL VIEWS OF SYSTEM FOR VENTILATING THE MOTORS.

These locomotives are able to haul a train weighing 170 tons, ex-

clusive of the locomotive, between Baker Street and Harrow at a maximum speed of 36 m.p.h.; and a freight train of 250 tons, exclusive of locomotive, over the Circle at a maximum speed of 27 m.p.h. The motors are of the usual series-wound railway type, and there is nothing novel in the winding. The drawing, Fig. 3, shows the details of the ventilating air ducts. The air is admitted to the motor at a pressure of 4 ozs. per square inch, and the mouth of the duct is so formed as to distribute the entering air over the entire end of the armature and field coils. The cover of the motor is of the ventilated type, so that this air, after it has absorbed the heat generated in the armature and in the field coils, is discharged into the atmosphere.

There are four motors with each locomotive, and these are arranged in pairs. Each pair of motors has a separate turret controller of the Westinghouse electro-pneumatic type. These controllers are manipulated by a single master switch and are not of the automatic type. The switches, however, are closed with the step by step method usual with tramway type controllers, this being necessary owing to the vast amount of shunting of freight and passenger trains in sidings.

The blower is fitted with a resistance which can be switched in shunt connection with the field coils, so that the speed may be increased 25 per cent., and the pressure of the air thereby increased from 4 ozs. per square inch to 6 ozs. per square inch. This arrangement will be used when the motors are working under the most severe conditions of service.

At a test on June 29, the first locomotive delivered was coupled to a freight train weighing 279 tons and made a number of successful trips between Willesden Green and Uxbridge. It has also been tested on the Harrow line, between Baker Street and Uxbridge, on passenger traffic with equally good results. A view of this locomotive is given in Fig. 5, which shows the arrangement of the trucks. The weight on each wheel of the locomotive is 12,530 pounds.

The ten locomotives on order will be used for hauling the Great Western trains through the northern part of the Circle between Edgware Road and Aldgate, for conveying the main line passenger traffic from Pinner, Rickmansworth, Verney Junction, etc., between Harrow and Baker Street, and also for hauling freight trains over both the Circle and St. John's Wood Line. Owing to the length of the trains and the cramped conditions existing at the termini, it has been necessary to keep the length of the locomotives down to the lowest possible limit. This has been effected by using motors of a smaller size than usual and equipped with forced ventilation, as detailed above.

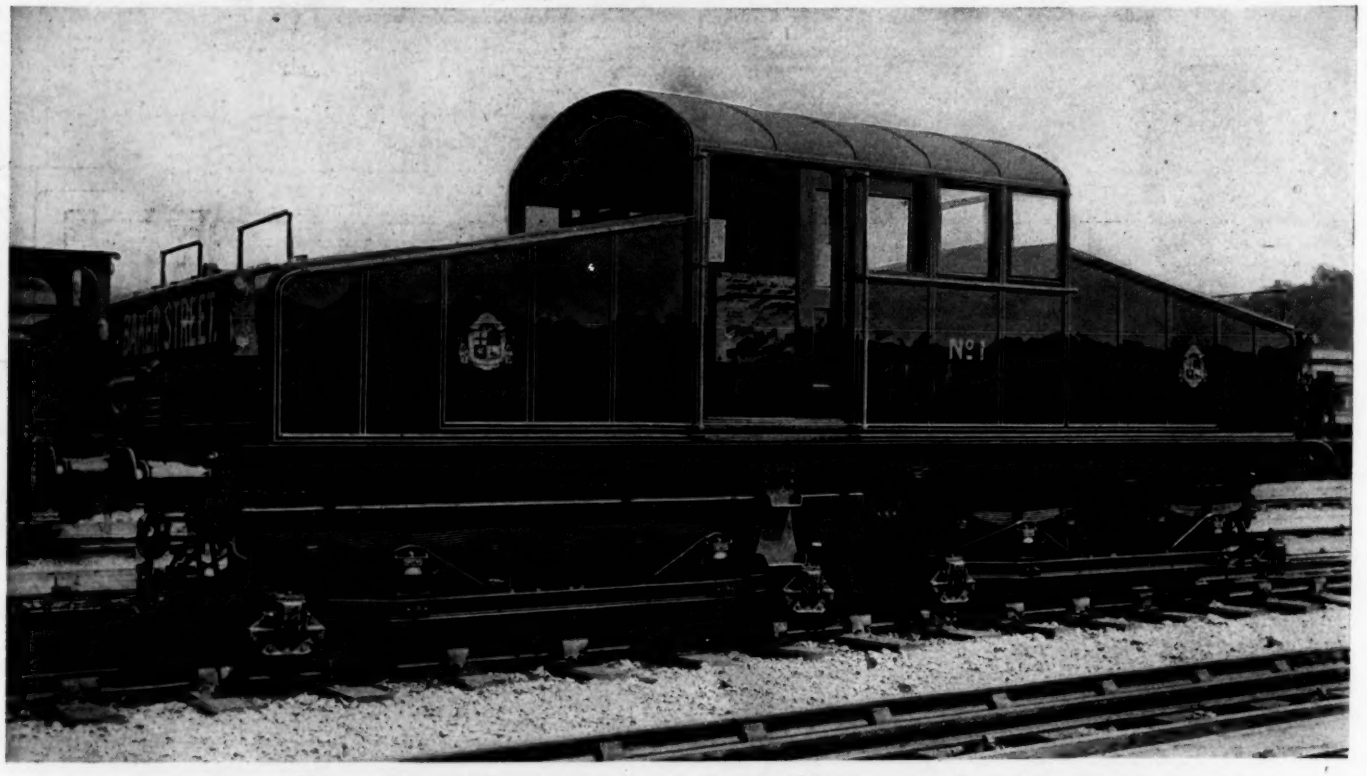


FIG. 5.—ELECTRIC LOCOMOTIVE FOR THE LONDON METROPOLITAN RAILWAY.

Ohio Lighting Convention Exhibits.

The exhibits at the Ohio Electric Light Convention last week were not numerous, but a large number of supply men attended. (See report on page 350.)

WESTINGHOUSE COMPANIES EXHIBIT.—The exhibit of the Westinghouse Companies, which occupied a large parlor on the ground floor of Hotel Victory, was attractive and complete. The exhibit comprised a full line of portable electrical measuring instruments alternating and direct-current arc lamps, transformers, lightning arresters, switches, alternating and direct current for motors, ammeters, voltmeters and wattmeters. The prepayment wattmeter which was on exhibition attracted much interest. A complete line of samples of Sawyer-Man incandescent lamps was displayed in a glass case. On a large display board were shown fuses of sizes suited to various voltages. The corridor of the hotel on the ground floor where all of the exhibits were made was illuminated by Westinghouse alternating-current arc lamps. Samples of Nernst lamps were also exhibited. The following representatives of the various Westinghouse interests were in attendance at the convention: Westinghouse Electric & Manufacturing Company—C. B. Humphrey, manager detail sales, Pittsburg; C. B. Dusinberre, manager Cleveland office; R. W. Beebe, Cleveland office; N. C. Draper, Cleveland office; W. C. Egert, Cleveland office; J. W. Schantz, Cincinnati office; Lawrence Moore, Detroit office; W. P. Jend, Columbus office; J. H. Klinck, Pittsburg office. The Westinghouse Air Brake Company—T. W. Newburn, Cleveland office. The Westinghouse Machine Company—J. H. Wagenhorst, Cleveland office. Nernst Lamp Company—Max Harris, sales manager, Pittsburg; E. R. Roberts, Pittsburg office; James Anderson, Columbus office; J. F. Hoover, Buffalo office; C. H. Davis, Detroit office. J. C. McQuiston, superintendent of the Westinghouse Companies Publishing Department, Pittsburg.

The Benjamin Electric Manufacturing Company, of Chicago, had a parlor where Mr. S. R. Fralich showed its line of arc "bursts," both ceiling and pendant forms; also samples of its regular lighting specialties. Mr. Fralich reports good success within the past year. One of the recent installations was for the United Railways of St. Louis, consisting of two-light series car clusters.

THE LIBRARY BUREAU, represented at Cleveland by Mr. T. E. Crawford, Ohio agent, and Mr. Horace A. McKee, of Chicago, showed an interesting line in one of the parlors on the ground floor of card record-keeping systems, including samples of outfits in use by the Cleveland Electric Illuminating Company and the Northern Ohio Light & Traction Company. The line consisted of card meter-

reading systems and meter-record systems, billing systems and miscellaneous central stations accounting of all kinds. Mr. H. A. McKee, of the Chicago office, was also in attendance. There were also shown vertical systems of handling correspondence for electric lighting companies, and forms used by Chicago Edison Company and Pennsylvania Gas & Electric Company, Peoria, Ill.

THE FORT WAYNE ELECTRIC WORKS was represented by Mr. A. A. Serva, who showed a new prepayment integrating wattmeter, for which strong claims are made. This meter was designed by their Mr. J. J. Wood, the well-known inventor.

THE GENERAL ELECTRIC exhibit was in charge of Mr. H. I. Mauger, of Schenectady. With him were the following: N. R. Birge and R. E. Russell, Schenectady; F. W. Wilcox, J. I. Solomon, of the Edison Lamp Wks., Harrison, N. J., and W. D. A. Ryan and G. H. Stickney, of Lynn, Mass; W. J. Hanley, Cincinnati. The piece de resistance of the General Electric Co. at this meeting was by all odds the illustrated lecture by Mr. Ryan; but the exhibit was an interesting one, covering a complete line of electric cooking devices, including flatirons, cigar lighters, glue pot, etc. Indestructible and interchangeability as to parts are prominent features of this system of heating apparatus.

The following companies were represented at the convention by the gentlemen whose names are given:

ALLIS-CHALMERS AND BULLOCK E. M. Co.—F. C. Colwell, Cincinnati, O.

AMERICAN CIRCULAR LOOM Co.—Thos. H. Bibber, Chelsea, Mass.

ATLAS ENGINE Co.—John A. Bechtel, Cincinnati, O.

BANNER ELECTRIC Co.—R. T. Hamilton, Youngstown, O.

BENJAMIN CLUSTERS.—S. R. Fralick, Chicago, Ill.

THE F. BISSELL Co.—F. M. Knierim, Toledo, O.

BRYAN-MARSH Co.—F. W. Godfrey, Chicago, Ill.

DOUBLEDAY-HILL ELECTRIC Co.—Elliott Reynolds, Pittsburg, Pa.

DUNCAN-HOBSON ELECTRIC Co.—C. W. Hobson and S. A. Dobson, Dallas, Texas.

ELECTRIC APPLIANCE Co.—Perry R. Boole and George H. Porter, Chicago, Ill.

THE ERNER & HOPKINS Co.—H. B. Rogers, Columbus, O.

F. D. LAWRENCE ELECTRIC Co.—C. S. Kuntz, Cincinnati, O.

NAGEL ELECTRIC Co.—H. E. Adams and Ernest J. Paradis, Toledo, O.

NATIONAL CARBON Co.—A. G. Summerell, Cleveland, O.

JOHN A. ROEBLING'S SONS Co.—J. W. Brooks, Cleveland, O.

SANDERSON & PORTER.—Leo A. Phillips, New York, N. Y.

STANDARD ELECTRIC Co.—G. F. Meyers and R. C. Stueve, Cincinnati, O.

STANLEY-G. I. ELECTRIC MFG. Co.—Laurence Clark, Chicago, Ill., and W. A. Ekberg, District Manager, Cincinnati, O.

STANLEY INSTRUMENT Co.—F. J. Alderson, Great Barrington, Mass.

TURBINE ENGINEERING Co.—L. G. Read, New York, N. Y.

WAGNER ELECTRIC MFG. Co.—G. Percy Cole, St. Louis, Mo.

BUCKEYE ELECTRIC Co.—F. W. Bliss, Cleveland, O.

CLEVELAND ELECTRICAL SUPPLY Co.—S. Griesser, Cleveland, O.

DUNCAN ELECTRICAL MFG. Co.—W. H. Sinks, Lafayette, Ind.

BURKE ELECTRIC Co.—J. W. Leech, Erie, Pa.

MILLER-SELDEN ELECTRIC Co.—W. H. Selden, Jr., Detroit, Mich.

POST-GLOVER ELECTRIC Co.—E. L. Van Winkle and P J. Williams, Cincinnati, O.

WARREN ELECTRIC MFG. Co.—W. M. Lenhart, Sandusky, O.

New Harmonic Ringer for Party Lines.

The principle of the harmonic system of selective party line signaling is now very well known. In brief, the system may be described as follows: Every reed has a natural period or rate of vibration, and by applying small impulses of force to this reed, it can be made to take up that particular vibration. If the same amount of energy were applied at a different rate, this particular reed would not respond. This fact being recognized it remained to design a ringer having a reed or armature which would be acted upon by electrical impulses sent over the telephone line from a suitable ringing machine in the telephone exchange. The accompanying illustrations show a ringer which is the outgrowth of a considerable number of experiments along this line, and it is confidently asserted by the makers that all the previous disadvantages have been overcome.

In Fig. 1 is shown a front view of this new ringer. The method of adjusting the positions of the gongs should be particularly noted. The studs to which the gongs are fastened are inserted in slots at either end of the yoke which joins the two cores of the ringer. Through these studs there passes a threaded set-screw, on the outer end of which is a square head with two flanges. These two flanges rest in the upturned grooves on the ends of the yoke. The stud is held down to the yoke by means of two lock-nuts and a spring washer, which is placed over the threaded end of the stud immediately

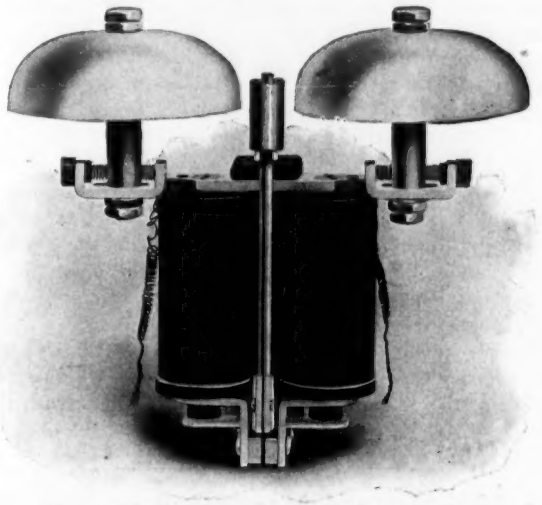


FIG. 1.—FRONT VIEW OF HARMONIC RINGER.

under the yoke. This method of fastening the studs makes a very firm connection. In adjusting the positions of the gongs it is necessary merely to turn the two set-screws in either direction, thereby bringing the gongs either nearer or farther away from the tapper.

The tapper, it will be noticed, is a cylindrically-shaped bar at the top of the tapper arm. It is securely fastened to the tapper arm so

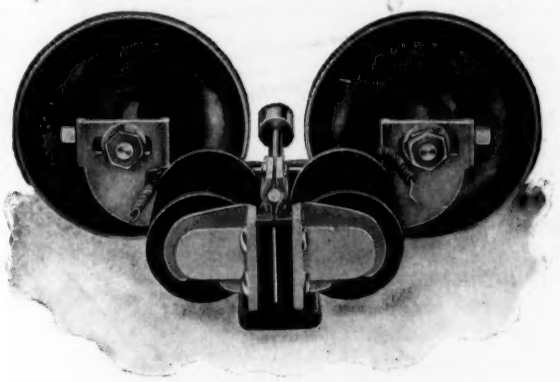


FIG. 2.—END VIEW OF RINGER.

that there is no possibility of that part of the ringer ever getting out of adjustment. In order to furnish the four different ringers necessary for the different party lines, four tappers of different lengths have been made. The tapper arm is securely riveted to the armature, and the armature is riveted to the steel spring upon which the tapper mechanism vibrates.

In case it is desired to change the ringer in a certain telephone instrument to another party on the line, it is necessary merely to

FIG. 3.—PARTS OF RINGER.

loosen the lock-nuts at the lower ends of the spools, which makes it possible to remove the whole armature and tapper mechanism, and another set can be inserted in its place. This simple operation does away with the old system of transferring wires onto different clips in the different telephone instruments, and also makes it possible to connect all of the telephones on the line in exactly the same manner throughout.

Fig. 2 shows an end view of the ringer and gives a fair idea of

the construction of the armature end of the ringer. Fig. 3 shows part of the ringer disassembled, and indicates the general construction of this ringer. The adjustment of the space between the armature and the magnets is accomplished by the pole pieces, which are screwed into the cores of the magnets. These pole pieces can be raised or lowered, and any of the necessary adjustments may easily be obtained.

This ringer is very efficient on account of the fact that the permanent bar magnet is in metallic contact with the armature of the ringer. Another very important advantage which this harmonic ringer possesses resides in the fact that it can be placed in any common-battery telephone to take the place of an ordinary single-party polarized ringer. This is especially valuable to operating companies who wish to change their ordinary instruments to four-party instruments without the expenses which would otherwise be necessary in the installation of entirely new telephones. It may also be stated that when this ringer is used in any telephone the appearance of the same from the outside differs in no way from the ordinary ringer, and unless a person opened up the telephone and examined the ringer it would be impossible to tell the instrument equipped with this ringer from a single-party telephone.

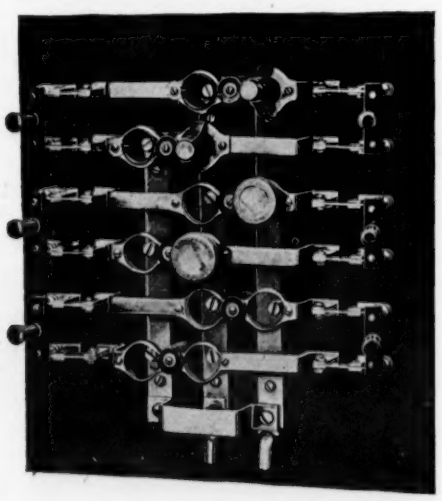
This ringer is being placed upon the market by the Kellogg Switchboard & Supply Company, Chicago, which was a pioneer in the development of the four-party harmonic system of selective party-line signaling.

The Universal Direct-Connection Panel.

Among the many annoying details of the interior wiring business, the troubles due to panel boards are, perhaps, the most difficult to overcome. It is evident that the panel is the most conspicuous part of a concealed-wiring installation, and that the use of make-shift apparatus for this portion of the equipment should not be tolerated. To procure a suitable panel from the manufacturer, frequently involves a delay in the completion of the undertaking, because it is almost out of the question for a single dealer to keep on hand a complete stock when the requirements of the various installations are so essentially different. The universal direct-connection panel, illustrated herewith, has been designed to eliminate the trouble mentioned above.

This panel can be used for two-wire or three-wire work, with plug, link or enclosed fuses. Each tablet being adaptable in this way, it is only necessary for the contractor or dealer to have on hand a few sizes of fuses and switch panels to be certain of supplying from the stock exactly the board required. In addition to this valuable feature these boards are smaller than any other approved tablet at present to be found on the market.

In the construction of these boards, the circuit terminal of the



SIX-CIRCUIT TABLET SHOWING ADAPTATIONS.

switch base is carried over the bus-bar and formed into a fuse plug receptacle, so located that the fuses make direct connection with the bus-bar. By this means the bus-bars are covered by the branch bars, and an accidental short circuit involving the mains is practically impossible. When the fuses are removed all the exposed metal work except the main terminals is disconnected.

This panel is manufactured by Johnson & Morton, Utica, N. Y., which company has given considerable attention to the working out of the details of the board, all parts being of the best material and workmanship.

Electric Flatirons.

Apropos of our recent editorial on the support that central station managers should give to electric heating devices, we note that the General Electric Company has just placed an improved flatiron on

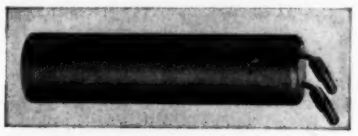


FIG. 1.—RESISTANCE UNIT.

the market. It is said some 5,000 have already been shipped and that one of the largest laundries in the world is using them exclusively.

The heating unit of this iron is a resistance coil of liberal cross-section enclosed in a metal shell. This coil is so designed that the heat flows to the work as fast as it is generated. The iron thus re-

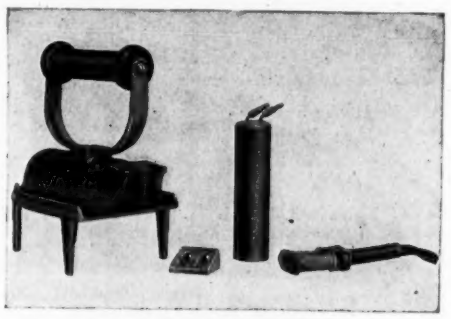


FIG. 2.—PARTS OF FLATIRON.

mains evenly hot under the most constant use, and no work is delayed by a cold iron or scorched by an overheated one. The resistance unit is of the highest efficiency and durability and may be easily renewed when necessary. Only enough metal is used to carry

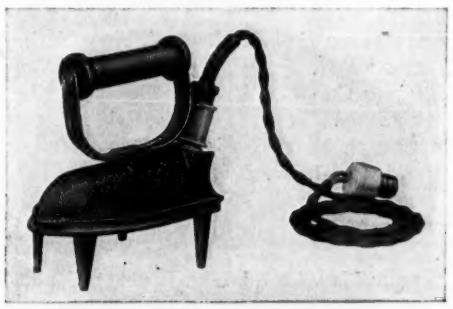


FIG. 3.—FLATIRON COMPLETE WITH FLEXIBLE CORD AND PLUG.

the heat from the resistance unit to the work, the requisite weight being in the handle. This gives a far better balance to the iron than was possible in the old kind. The handle is made of fibre and remains cool. The iron is so shaped as to insure an even temperature at its face, and its high polish greatly facilitates the work. It is so designed as to meet practical laundry needs, and has been found to be far easier to insert in plaits and ruffles than the ordinary kind.

Each flatiron is furnished with a stand, eight feet of special flexible cord and a porcelain detachable plug which fits the heavy brass contacts of the iron. Repeated endurance tests, made by allowing the iron to remain 1,000 hours on its individual stand, with the current turned on, have conclusively proved the durability of the General Electric flatiron.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE was, on the whole, very satisfactory. While holiday making and taking goes on briskly, so that all the resorts are doing well in spite of rather poor weather, great preparations are evident on every hand for fall and winter trade. The conditions are summed up by *Dun's Review* as follows: "It is becoming a year of superlatives in the business world; prices of the sixty most active railway securities have reached the highest point on record; output of pig iron in the first half of 1905 not only far surpassed any preceding six months' production, but exceeded every full year prior to 1898; prices of hides are at the highest position since the Civil War; wool quotations have not been as strong since the early eighties; shipments of footwear from Boston are close to the maximum, and, including all shoe centers, the movement this year is beyond precedent; foreign commerce in July surpassed the corresponding month in any previous year." As a general thing all these conditions are good, but the price movement might easily be pushed now to a dangerous point by undue speculation. "Lest we forget" is a good motto, and sober activity a good plan. *Bradstreet's* remarks: "Fall trade, while not yet under full headway, is steadily gathering force. Buyers are more numerous and their operations more confident than at any previous time this year. Contributory favorable influences at leading Western markets have been needed rains in the corn belt, which all but assure a record crop, barring an early frost. Good weather for harvesting and threshing except in portions of the Northwest, continues to reveal very favorable results in both Spring and Winter sown grains. Combined cereal yields will probably exceed all past years in both quantity and quality. Relatively high prices for agricultural products, manufactured materials and staple products do not deter buying operations. Collections, on the whole, have improved slightly, and even in the South, except in a small area of the fever-infected zone, trade and collections are alike better than anticipated earlier, while the West and East also return more favorable advices." The copper market has continued strong, and prices for Lake and Electrolytic were 15.87 to 16, with apparently a limited supply. Casting copper was quoted at 15¼ to 15½.

ELECTRICAL WIRE MANUFACTURE.—The Wire & Telephone Company of America has taken over the plant of the Empire Wire Company and the Electric Wire Works of Rome, N. Y. The latter has a plant for the manufacture of bare and magnet wire. All the old contracts made by the Empire Wire Company will be carried out by the new concern. The company will maintain its general offices and works at Rome and branch office at 43 Exchange Place, New York. The directors are: C. F. Niles, president; J. S. Dyett, vice-president; Walter C. White, vice-president; H .T. Dyett, secretary and treasurer; Oliver Shiras, chairman executive committee. The directors are these and S. C. Houghton, Robert A. Downey, F. M. Potter, Jr., and Thomas H. Stryker. A new building is to be erected by the company for an insulating department and telephone supply department. The new building will be of brick construction 50x250 feet in size and will be arranged so that it can be extended. The improvement will involve an outlay of $60,000 and when completed the company will be ready to make bare wire, magnet wire, telephone instruments, switchboard cables and cords, etc., in large quantities.

TELEPHONE EQUIPMENT FOR DECATUR, ILL.—The International Telephone Manufacturing Company, of Chicago, has been awarded a contract to furnish a complete new central office equipment for the Macon County Telephone Company, of Decatur, Ill. The board will be a full multiple lamp line signal equipment especially arranged for magneto service and in such a manner that it can be changed to full central energy with double line supervisions without discarding any of the equipment already installed and without interfering with the service. It is proposed by the Decatur Company to change to full central energy as soon as it is found convenient to overhaul the outside construction, changing that to full multiple instead of common return and grounded lines. The re-equipment of the central office, besides affording much more rapid and satisfactory service to the subscribers, will result in a direct saving to the company, as the exchange can be operated at a saving of fully one-fifth of the operator hire, to say nothing of the decreased cost for maintenance.

BIDS FOR CHICAGO SANITARY EQUIPMENT.—Bids will be received until October 11 by the Board of Trustees, Sanitary District, Chicago, for furnishing electrical apparatus and materials and for installing same in the power house of the Sanitary District of Chicago near Lockport, and transmission line along the right of way. Bids may be submitted as a whole or separately on the following: Main switchboard and instruments, transfer boards, oil circuit-breaker switches and knife switches, remote-controlled rheostats for generators, bus-bars and bus-bar and circuit compartments, conduits, service-wiring, transformer and generator connections, transformers and lightning arresters, transmission line towers or poles, erecting towers or poles, copper and aluminum conductors, erection of cable, high tension insulators, electric traveling crane. The cost is reported to be $160,000. Address S. D. Griffin, clerk, Lockport, Ill.

EQUIPMENT FOR APARTMENT HOUSES.—Mr. Percival R. Moses, 320 Fifth Avenue, New York, has been retained as consulting engineer for five six-story apartment houses filling a complete block on the north side of West One Hundred and Thirty-Seventh Street, between Broadway and Riverside Drive, the Transit Realty Co., owners, Moore & Landsiedel, architects. There will be an isolated plant to supply these buildings with heat, light and power, located in the westerly building, consisting of three 125-hp boilers, three simple automatic high speed engines of 100, 80 and 65-hp capacity, direct-connected to 60, 50 and 40 kilowatt, direct-current, compound wound, 110-volt dynamos. There will also be a storage battery to take care of fluctuations in voltage due to elevator load.

CONTRACTS IN GERMANY.—Contracts are in the market for electric power and lighting, electric railways, water and sewerage works, gas works, public baths and buildings, etc., as the case may be, to be paid for out of bonds issued by the following German municipalities, to the amounts set opposite each: Dresden, $9,520,000; Halle, $1,166,000; Worms (Hessen), $714,000; Reinscheld, $497,000; Loerrach, Baden, $266,000; Erfurt, $238,000; Breslau, $208,000; Kissingen, $166,000; Hirschberg (Schlesien), $95,000; Balingen, I. W., $75,000; Rudesheim-on-the-Rhine, $54,000. Electric railways are also to be constructed as follows: From the city of Crefeld to the two manufacturing towns, Suechtein and Viersen; from Kreuznach, a celebrated bathing resort, to Muenster and Stein.

NEW YORK CENTRAL SHOPS.—The New York Central Railroad is preparing to enlarge its machine shops at some points, and plans have been filed with the Bronx Building Department for several structures to be erected at Sedgwick Avenue, High Bridge, New York City. A one-story frame electric locomotive shop 24x176 feet in size will be erected, besides a roundhouse, to cost $24,000, a sand house, shops and an office building. These structures are to be erected to be used in connection with the electric service. In addition to that the company will erect a two-story brick power station at 153d Street and Sheridan Avenue, New York. The station will be 61x242 ft. in size and will cost about $58,000.

BELL TELEPHONE OUTPUT.—The instrument report of the American Telephone & Telegraph Company for the month ending July 31 is as follows:

	1905.	1904.	1903	1902.
Gross output	114,897	80,348	69,194	59,935
Returned	63,979	42,842	44,116	34,054
Net output	50,978	37,506	25,078	25,881
Since December 31:				
Gross output	1,012,517	672,032	669,258	649,044
Returned	347,521	290,032	279,257	260,321
Net output	664,996	382,000	390,001	388,723
Total outstanding	5,145,560	4,161,517	3,450,321	2,914,735

THE CROCKER-WHEELER COMPANY is in receipt of an order for a 200-kw, three-phase, 60-cycle, engine-type alternating-current generator for the Ivorydale, Ohio, lighting and power plant of the Proctor & Gamble Company. This machine is a duplicate of the first Crocker-Wheeler alternator ever built, which was installed ten months ago in the Atlanta plant of the Proctor & Gamble Company. The high efficiency and excellent performance of the earlier machine led the purchaser to order a duplicate.

TELEPHONE EXCHANGE CONTRACT.—The Central Union Telephone Company has awarded to the firm of V. Jobst & Sons, of Peoria, the contract for building the new four-story office building which the company will erect there this year. The building will be the headquarters for the Illinois division of the Bell Telephone system. The bid of Jobst & Sons was $50,000.

G. M. GEST, the expert subway contractor of New York and Cincinnati, has been awarded a contract at Fitchburg, Mass., for the construction of a complete subway system for the Fitchburg Gas & Electric Light Company. This makes the fifth city in Massachusetts in which Mr. Gest has constructed conduit systems.

NEW CARBON COMPANY.—One of the Cleveland papers has the following as to the projected new carbon company already noted in these columns: "A new carbon company probably will be incorporated under the laws of this State next week. It will enter the field as a competitor of the National Carbon Company. The United States Carbon Company will be the nucleus of the new concern, which will have another name. The plans of the new company were briefly outlined by M. B. Daly, manager of the East Ohio Gas Company, who recently purchased the United States Carbon Company. Mr. Daly said that the new company probably would be capitalized at $500,000. Men of sufficient means were interested, he said, to make it appear that the enterprise would be successful. "The men who are interested in the new concern believe that the field is large enough to warrant the investment of their money," said Mr. Daly. "I am not authorized to state who are associated with me in the venture. It is possible that the names of some of them will not appear among the names of the incorporators. This is not backed by Rockefeller interests. I will not say, however, that some of the men interested do not have Standard Oil Company associates. John D. Rockefeller has no direct interest in the company. We expect to have friendly relations with our competitors. The plant in Cleveland will be enlarged and improved at an estimated cost of about $100,000. Mr. Daly said that if the company's business required it other plants might be established, mostly in Ohio. The company probably will be organized and officers elected within ten days."

POWER PLANT FOR GOLDFIELD.—It is stated that the wonderful new mining camp in Nevada, Goldfield, is to have a new electric power company, another railway and a cyanide and chlorination plant of 500 tons daily capacity. Three million dollars has been pledged to carry the project through. Millionaire coal, iron and oil men will control the affairs of the company. For the past six months Colonel E. F. Browne and J. M. Hower, Jr., president and principal owner of the Dorcas mill at Florence, Col., have been giving careful attention to the project. They have secured over 1,000 acres of coal land near Coaldale, 47 miles in an air line northwest of Goldfield. The land has been paid for and prospected, and in a blanket vein which has an average thickness of five feet coal that will do for steam purposes has been proven up in a dozen or more places. Water has been developed on the ground, and it is estimated that it can be pumped to the mill at a cost of three cents for each 1,000 gallons. An electric railway will be constructed from the mill to Goldfield, and a preliminary survey has already been made.

POWER PLANT FOR SPRING RIVER.—Mr. F. A. Sager, of the Arnold Company, engineers, Marquette Bldg., Chicago, Ill., writes in regard to the power plant for the Spring River Power Company, that the electrical equipment for this plant has been purchased, viz.: One of the 2,000 kw Westinghouse units that was installed at the Louisiana Purchase Exposition, together with the necessary 6,600-33,000 volt, step-up transformers, switching apparatus, steam driven exciter set, lightning arresters, etc.; while 2,400 hp of Heine boilers have been purchased. Bids have been received and contracts will soon be let for other equipment, including condensers and the necessary pumps. The plant will be at Varck, about three-quarters of a mile from the hydro-electric plant recently installed for the Spring River Company, and will be operated in parallel with it, to supply additional power to the mines in the vicinity of Joplin and Webb City.

NAVY SUPPLIES WANTED.—Bids will be received until Sept. 5 by the Bureau of Supplies and Accounts, Navy Dept., Washington, to furnish at the navy yards, etc., Portsmouth, N. H.; Boston, Mass.; New York, N. Y.; League Island, Pa.; Annapolis, Md.; Washington, D. C., and Norfolk, Va., a quantity of naval supplies as follows: Motor, electrical supplies, arc lamps, ventilating sets, starting rheostats; also Sept. 19 to furnish at the navy yards, Mare Island, Cal., and Puget Sound, Wash., the following: Motors, circuit breakers, electrical wire. H. T. B. Harris, Paymaster-Gen., U. S. N.

THE UNITED ILLUMINATING COMPANY OF MAINE has established a purchasing office at Belfast, Me., with Mr. C. F. Gardner in charge. The United Company owns and operates the following plants in Maine: Belfast Gas & Electric Company, Eastport Electric Light Company, Farmington Electric Company, Fort Fairfield Electric Company and Winsor Gas Company. This constitutes quite a large system for which considerable apparatus, supplies etc., are needed from time to time.

INDEPENDENT TELEPHONE MERGER.—A committee composed of E. J. Balbridge of Duquoin, J. B. Bundy and D. M. Parkinson of Carbondale and Dr. Willard of Anna, representing the local independent telephone companies of Southern Illinois, has completed the work of invoicing the stock of these companies, and has arranged for other details pertaining to the proposed merger of the local companies into a gigantic telephone combine.

NEW YORK POLICE WIRES.—Bids will be received until Aug. 31 by Wm. McAdoo, Police Comr., for furnishing electrical conductors and placing electrical conductors underground. It is said to be likely that a large amount of work will soon be offering also in connection with the fire alarm system, which is now sadly in need of extension and improvement.

Financial Intelligence.

THE WEEK IN WALL STREET.—The strong report of the Government as to the crop conditions was followed very naturally by activity and buoyancy in the stock market, for the large figures and high percentages came to reinforce an outlook already favorable. The effect on railroad securities was naturally very marked, but industrials and all other stocks benefited. While a peaceful outcome of the negotiations at Portsmouth is hoped for, the resumption of hostilities is now hardly likely to have any serious depressing effect on the American market; although the whole public is devoutly praying that the sword may soon be sheathed. The fact that bank clearings are 27 per cent. better than last year tells its own story. It is true, prices look high on the stock list, but in many quarters there is a strong belief they will go much higher; and it is not to be forgotten that several large railway systems have increased their dividend rate since 1904. The following little table is of interest, as to electrical stocks and those of a kindred nature:

	Aug. 19, 1905.	Aug. 19, 1904.
Allis-Chalmers, com.	17⅛	11
Allis-Chalmers, pf.	56	50
Am. Dist. Tel.	31½	22
Amer. Tel. & Tel.	143	139
Gen. Elec. Co.	184	165
Manhattan Elev.	166¾	154¾
Pressed Steel Car, com.	47	33
Pressed Steel Car, pf.	96⅝	76
Toledo Rys. & Lt.	34¾	21
United Rys. Invest. Co., com.	72½	14
United Rys. Invest. Co., pf.	89	53
U. S. Steel, com.	36⅝	11⅞
U. S. Steel, pf.	104½	58¼
Western Union Tel.	93¾	89¾
Westinghouse Elec.	171½	159¼

These figures are eloquent as to improvement in all respects, but of course do not stand alone, but are symptomatic. On the subject of prices, the Wall Street firm of Edey, Brown & Sanderson, well-known in electrical circles, says: "The prices of securities have, it is true, risen to an average height about equal to that in the fall of 1902 before the commencement of the gradual decline terminating in what was well termed 'the rich man's panic.' Therefore some might argue that the majority of stocks have again reached a point in height from which they must inevitably fall. The argument, however, is fallacious in that the premises in each instance are radically different. The railroad corporations of the country have enjoyed since then a great era of growth, and their value has been enhanced accordingly. The leading industrial companies have learned a lesson in conservatism which has grounded them on a more solid foundation. Enhancement in value of corporate isues which has taken place in the meantime is bound to be reflected in the market price, and we believe that a discrepancy exists between the market price and the actual value of standard securities at the present which still leaves room for considerable further improvement in prices. We base this belief primarily on the enormous traffic which must come to the railroads, and the largely increased wealth which will come to the country as a whole from the harvesting of this year's crops for such brilliant prospects." Below are given the closing quotations for August 22:

NEW YORK

	Aug. 15	Aug. 22		Aug. 15.	Aug 22
Allis-Chalmers Co.	17	17⅛	Electric Vehicle	19	19
Allis-Chalmers Co. pfd.	59	57	Electric Vehicle pfd.	24	..
American Tel. & Cable	90	90	General Electric	183⅛	182½
American Tel. & Tel.	143	142¾	Hudson River Tel.	..	..
American Dist. Tel.	30	30	Interborough Rap. Tran.	218	215¾
Brooklyn Rapid Transit	70⅛	*69⅛	Metropolitan St. Ry.	125¾	129⅛
Mackay Cos.	..	41	N. Y. & N. J. Tel.	..	..
Mackay Cos. pfd.	..	74	Marconi Tel.	..	..
Electric Boat	32	36	Western Union Tel.	93⅜	93¾
Electric Boat pfd.	75	75	Westinghouse com.	170	159½
Electric Lead Reduction	..	..	Westinghouse pfd.	..	..

BOSTON

	Aug. 15	Aug. 22		Aug. 15	Aug. 22
American Tel. & Tel.	143¾	142½	Western Tel. & Tel. pfd.	*99	..
Cumberland Telephone	117	117⅝	Mexican Telephone	1	..
Edison Elec. Illum.	253	..	New England Telephone	135	133¾
General Electric	183	182¾	Mass. Elec. Ry.	18	18
Western Tel. & Tel.	*18		Mass. Elec. Ry. pfd.	61	62

PHILADELPHIA

	Aug. 15	Aug. 22		Aug. 15	Aug. 22
American Railways	53	..	Phila. Traction	..	..
Elec. Storage Battery	81	83	Phila. Electric	8⅞	8⅛
Elec. Storage Battery pfd.	..	..	Phila. Rapid Trans.	28¾	28⅛
Elec. Co. of America	11¼	11⅜			

CHICAGO

	Aug.15	Aug. 22		Aug. 15	Aug. 22
Chicago Subway	..	..	National Carbon pfd.	115	115
Chicago Edison	..	155	Metropolitan Elev. com.	24	24
Chicago City Ry.	*196	..	Union Traction	..	..
Chicago Tel. Co	..	..	Union Traction pfd.	..	..
National Carbon	63	63			

* Asked.

PHILADELPHIA ELECTRIC.—With regard to the proposition of the Philadelphia Electric Company to reduce the cost of city lighting about $118,000 a year, the following from Philadelphia is of interest: "It was generally remarked that it was good business policy for the Philadelphia Electric Co. to reduce its price to the city for electric lighting. A disposition to recognize the ideas of those in control of municipal affairs, it is suggested, may go a long way toward warding off competition. While the Durham organization was in power, a larger appropriation from the city for lighting, and an increased number of lights was forthcoming almost every year, and there was no reduction in price. The net profits of the company in the meantime have been increasing from $100,000 to $150,000. As there is to be no larger number of lights in 1906, under the Mayor's schedule, and the present reduction in rates will lop-off over $100,000 revenue to the company, it is believed that next year may produce a comparatively small increase in the company's profits, should the present bid be accepted by the city. However the city lighting constitutes but a part of the company's business. The domestic lighting is well established, but should a competitor enter the field and a rate war be started it would be unfortunate for the company. A few years ago the Philadelphia Electric Company had of necessity to get the rates it received from the city to take care of the interest of its capital obligations, but the business has grown so that a substantial surplus is earned annually. Without any increase, earnings on a basis of those in 1904 would be over 70 cents per share on the 1,000,000 shares of stock now $10 paid in, and the present dividend on this amount is but 50 cents, and it is probable that 1905 will show some increase in profits. Despite denials it is believed in many quarters that there is good opportunity for extension of electric lighting in Philadelphia. Officers of the United Gas Improvement Co. are in the electric company board and are reported to be large holders of its stock. The opinions of 'outsiders' or competitors, are sometimes valuable, and in this connection is recalled what the attorney for the Commonwealth Electric Co. said, some six months ago, when the Mack management in the Keystone Telephone Company was trying to dispose of its conduit space and were talking about establishing an opposition electric lighting company. Their circular claimed that the average consumption of current per capita (exclusive of street lighting is only about $1.75 per annum 'which is the best evidence that the electric lighting business has never been developed in Philadelphia. In Boston, for instance, the average consumption per capita, is $5.57; in Butte, Mont., $7 per capita; Chicago, Ill., $2.59; Cincinnati, O., $3.20; Los Angeles, Cal., $8; Providence, R. I., $4.58; St. Louis with a population of only 575,000, consumes nearly as much current as Philadelphia with a population of 1,300,000. This is exclusive of street lighting, St. Louis being largely lighted by gas."

PENNSYLVANIA LIGHTING DEAL.—Note was made in these columns recently of the merger and consolidation of 15 electric light and gas companies in Luzerne County, Pa., into one company, with a capital of $1,000,000. The officers of the new concern are: C. H. Geist, of Philadelphia, president; H. W. Noble, Detroit, Mich., vice-president; C. B. Kelsey, Grand Rapids, Mich., secretary and treasurer. The corporations absorbed are the Wyoming Valley Gas and Electric, the Hazelton Gas Light, the Nanticoke Gas, the Plymouth Suburban Gas, the Hanover Township Gas and Illuminating, the Wyoming Gas and Illuminating, the Consolidated Gas Company of Wyoming; the People's Gas Company, of Swoyerville; the Swoyerville Electric Light Company, Shawnee Electric Light, the Dorranceton Light, the Hillside Light, the Courtdale Electric Light, the Luzerne Electric Light and the Kingston Light and Power companies. Mr. W. E. Anderson, formerly superintendent of the Bergen County Gas and Electric Company of Hackensack, N. J., has accepted the position of general manager of the merged Geist companies.

BOSTON ELEVATED is absorbing the West End Railroad outright. The terms of the consolidation thus far agreed upon are that the Boston Elevated is to issue $16,089,250 preferred shares to purchase the West End. St. Railway Co. shares, of which there are at present outstanding $6,400,000 8% cumulative preferred and $0,689,250 7% common stock. It is further agreed that the $16,080,250 new preferred shares to be issued by the Boston Elevated will not be considered in computing the rate of dividend paid by the Boston Elevated upon its present outstanding stock under the provisions of the special act under which it was chartered. The new preferred stock to be issued will probably have a par value of $100, while the par value of the West End shares is $50. With this change in the par value the new shares carrying a 4% dividend rate would show a dividend return equal to the 8% rate on the present 8% preferred stock, par $50. The West End preferred shares are now selling at $114 a share, showing a dividend return of 3.50%, while the common stock is selling at 97½, a dividend basis of 3.58%.

WESTERN TROLLEY PROPERTIES.—Four Boston electric traction properties in Indiana and Ohio are said to have been sold to the United Gas Improvement Co., of Philadelphia. They are the Indianapolis & Northwestern Traction Co., the Indianapolis & Western, the Columbus, Buckeye Lake & Newark and the Columbus, Newark & Zanesville roads, all of which were built, financed and managed by Tucker, Anthony & Co. It is understood that the sale involves the transfer of about $14,000,000 in cash and securities. The stocks are all sold for cash. The United Gas Improvement Co. has large traction interests in Indiana and Ohio and as the above four properties are well paying and growing roads, and possess strategic value in connection with the present owned United Gas Improvement roads, especially those running into Indianapolis, their purchase would seem to be justified by the Philadelphia interests. These properties have bonds of $6,500,000, preferred stock of $2,100,000, and common stock of $5,600,000.

INDEPENDENT TELEPHONE EXPENDITURE.—About $4,000,000 has been spent on improvements by the independents of Indiana in the past year. Among the improvements being made may be mentioned the following: The Mutual Telephone Company of Shelbyville is rebuilding its entire plant; the Crawfordsville Company is laying a large amount of cable; at Columbus additional telephones are being installed at the rate of fifty telephones per month; $15,000 additional is being expended in rebuilding the plant at North Vernon and in improving the lines; the New Long Distance Telephone Company has installed new circuits to Franklin, Greenwood and Veedersburg, and two new circuits from Indianapolis to Bedford; the Lafayette Company is expending about $75,000 on improvements; at Kokomo nearly three hundred new applications for telephones have been filed, and the capacity of the plant will have to be enlarged to accommodate these.

LIGHTING DEAL AT HELENA, MONT.—J. G. White & Co., of New York, and associates, have acquired the street railway, electric lighting and gas properties at Helena, Mont., known as the Helena Light & Traction Company. The electric railway system consists of about seventeen miles of line, the greater portion of which is single track. Current for both the street railway and the electric lighting system is supplied by the Missouri River Power Company. The incandescent and alternating power distribution is three-phase, sixty-cycle, 220-volt, and rotaries installed in the substation provide a direct-current power system of 550 volts. Howard S. Reynolds, superintendent of the operating department of J. G. White & Co., has been appointed manager of the company, and will leave shortly for Helena to assume his duties.

POWER IN MAINE.—The Messalonskee Electric Company, Oakland, Me., is to build another power station to develop 1,500 hp by water and 600 hp by steam auxiliary. It is possible that the steam plant will be established in connection with the company's existing plant. There is some question as to the distance which the power will be transmitted, and until this is decided the matter of electric generating apparatus will not be finally settled. Water turbines and other appliances of a hydraulic plant will be required. Mr. Leonard Metcalf, engineer, 14 Beacon Street, Boston, is the engineer for the plant.

FINANCING AN OHIO TROLLEY.—Luther H. Leber, son of J. Gilbert Leber, of York, Pa., has succeeded in negotiating a bond issue of $1,000,000 for the construction of the Shelbyville & Ohio River Electric Railroad Company's line through Carrollton, across the river, and to Eminence. Articles of incorporation have been filed at Frankfort. The work of securing right of way is in progress, and it is said the construction of the line will begin immediately after this is accomplished.

DIVIDENDS.—The King's County Electric Light & Power Co. has declared its regular quarterly dividend of 2 per cent. on its capital stock, payable Sept. 1. The Pressed Steel Car Company, Pittsburg, has declared the regular quarterly dividend of 1¾ per cent., payable August 29. The Philadelphia Company of Pittsburg, controlling the electric street railway lines in that city, has declared the semi-annual dividend of 2½ per cent. on the preferred stock, payable Sept. 1.

GOOD EARNINGS.—The Detroit United Railways report gross earnings for July of $502,865 against $452,998 last year and in 1903 also. The surplus for seven months is $489,546, a gain of over $150,000. The Toledo, O., Railways & Light Co. reports July gross at $171,994 against $153,377 last year, and the sixth months' surplus at $222,257 against $157,917 in 1904. These are healthy gains.

POWER BONDS.—Harvey Fisk & Sons, New York, will underwrite $10,000,000 of bonds of the McCall's Ferry Power Company, which proposes to build the large power plant at York, Pa., to supply electric power to Philadelphia, Lancaster and adjacent towns.

General News of the Week

The Telephone.

MOBILE, ALA.—A special meeting of the stockholders of the Home Telephone Company has been held for the purpose of approving a proposition to increase the capital stock to $350,000 and to issue bonds in a like amount, the proceeds to be used in the extension and betterment of the plant.

SANTA CRUZ, CAL.—P. Kerr Higgins, of Los Angeles, has sent an application to the City Council to construct and maintain a telephone system for this city for a term of 50 years.

VALLEJO, CAL.—F. E. McBeth, for the Home Telephone Company, has applied for a franchise for Vallejo for fifty years, the company to spend the sum of $40,000 in construction of the system over a period of two years.

OAKLAND, CAL.—It has been recommended by the Judiciary Committee of the Council to authorize the Board of Public Works to advertise for bids for placing all wires used by the fire alarm and police telegraph department underground. The sum of $8,500 is to be appropriated.

CORONA, CAL.—An application for a franchise for the term of five years for a telephone and telegraph system, erecting poles, etc., in the streets and alleys of this city, has been made by A. C. Wood, a director of the Corona Telephone & Telegraph Company, capitalized at $25,000. The Council has adopted a resolution granting the sale of the franchises for thirty years and fixing October 1st as the date of the sale.

FLORENCE, COL.—The Colorado Telephone Company will erect telephone buildings there and at Canon City, the construction to begin early next year. About the same time the company will begin rebuilding the entire system in these two cities and will install the central energy systems. Thirty-five thousand dollars will be necessary to thoroughly equip Florence and more money will be needed at Canon City.

ROME, GA.—The Southern Bell Telephone Company will expend about $40,000 in improvements. A lot has been purchased corner of Broad Street and Fourth Avenue on which will be erected a handsome exchange. All of the wires on Broad Street will be put under ground.

MALAD CITY, IDAHO.—The Utah Independent Telephone Company has made application to the County Commissioners for a franchise.

COEUR D'ALENE, IDAHO.—The Rocky Mountain Bell Telephone Company will extend its line from St. Maries to St. Joe. A through circuit will also be put in from Harrison to Spokane by way of this place.

ATHENS, ILL.—The Indian Point Telephone Company has voted to sell its interests to the independent company which is establishing a system in this county.

WASHINGTON, ILL.—The Farmers' Mutual Telephone Company, of Washington County, Ill., has been formed; capital, $1,000. Incorporators, J. J. Randall, C. H. Buhmester and J. McDowell.

SPRINGFIELD, ILL.—The Central Union Telephone Company will spend a quarter of a million dollars here. Of this $100,000 will be used in underground wires in fire districts, and the remainder in buildings.

BLOOMINGTON, ILL.—Since the Kinlock syndicate got control of the Home Telephone system, plans have been formulated for improving the service. The company will probably go before the City Council with a petition asking for permission to place telephone wires underground throughout the city. It has already underground work in the business section.

EAST ST. LOUIS, ILL.—The Bell Telephone Company is having plans drawn by Eames & Young, architects of St. Louis, for an exchange building to be located on the corner of Eighth Street and Missouri Avenue, to be 75x100 feet, three stories in height, concrete foundation, of brick, stone and terra cotta; of strictly fireproof construction, steam heat, plate and art glass, electric elevator, tile floors, composition roof, copper gutters, iron and steel beams and columns, combination light fixtures; estimated cost, $75,000.

HUNTINGTON, IND.—It is stated that the Bell Telephone Company will rebuild its plant here at a cost of $20,000.

NOBLESVILLE, IND.—The Central Union Telephone Company, which for several years has had but few telephones in this county outside of the toll stations, is preparing for an extensive invasion of the local field. The company is proposing to make a low rate. A number of Indianapolis and local business men have under consideration the organization of a new independent company.

HUNTINGTON, IND.—Huntington's local telephone service is to be greatly improved before the end of the present year. Additions and alterations at a cost of $20,000 will be made as soon as the material arrives. Several miles of cable will be strung, part of it under ground, and the whole plant will be improved. The switchboard will be enlarged to accommodate at least 200 more telephones.

MALLARD, IA.—The Mutual Telephone Company has been incorporated by F. J. Lodes, president; O. A. Brownlee, secretary; capital, $12,000.

EXIRA, IOWA.—The Exira & Audubon Township Mutual Telephone Company now has several telephones in service and new ones on hand to put in as soon as the poles can be finished. Oscar Wheeler, president of the company, has the contract to put up the additional line needed.

LARNED, KAN.—The Pleasant Valley Telephone Company has been formed with a capital of $2,000.

WHITING, KAN.—The Farmers' Mutual Telephone Company has been organized with a capital of $9,600.

BALTIMORE, MD.—Upon the complaint of the Maryland Telephone & Telegraph Company and the filing of a bond for $5,000, an injunction has been granted by Judge Dobler restraining the Consolidated Gas, Electric Light & Power Company and its agents from cutting or removing the Maryland Telephone Company's wires from two poles on the east side of Exeter Street, and from interfering in any manner with the repair and replacing by the Maryland Telephone Company of two 10-pin cross-arms and wires on the poles.

BESSEMER, MICH.—The Michigan Telephone Company is extending its line from here to Sidaw to connect the Gogebic Range with Marquette and the copper country.

ST. JOSEPH, MICH.—The Twin City Telephone Company will expend $25,000 in improvements. A multiple switchboard is being installed. The Bell Company with which the Twin City Telephone Company connects is planning to expend $35,000 in St. Joseph.

GRAND RAPIDS, MICH.—The capital stock of the Citizens' Telephone Company will be increased from $2,000,000 to $3,000,000. The increase in the capital stock is for the purpose of erecting new exchanges and improving the old ones in the territory of the company.

ONSTEAD, MICH.—At the annual meeting of the Onstead Telephone Company the following officers were elected: President, L. S. Mann; vice-president, E. C. Turner; secretary, J. B. Daniels; treasurer, C. W. Greenleaf; board of managers, L. S. Mann, chairman; Fred Stoddart and Warren Shepherd.

AKELEY, MINN.—Work has been started for the construction of the local telephone exchange.

VIRGINIA, MINN.—J. Shanedling will erect a two-story brick office building to be occupied by the local telephone exchange.

COBDEN, MINN.—A franchise has been given the Springfield & Citizens' Mutual Telephone Company to enter the village.

GLENWOOD, MINN.—A new telephone company has been organized with a capital of $5,000 and a local exchange will be put into operation.

MINNEAPOLIS, MINN.—The telephone and electric light companies confront a proposed cost of $2,000,000 to put their wires under ground within the limits of the city of Minneapolis.

LEWISTOWN, MONT.—The Lewiston Telephone Company will reconstruct its lines and build a two-wire line to Great Falls.

BOZEMAN, MONT.—The Rocky Mountain Bell Telephone Company has purchased a site for the new telephone exchange which will be erected soon.

HELENA, MONT.—The management of the Lewistown Telephone Company announces that the system as far as Great Falls will be practically rebuilt at an expense of about $25,000.

INDEPENDENCE, MO.—Theodore Gary, the Macon capitalist who recently purchased the Home Telephone system in this city, proposes starting improvements on the plant.

NOVINGER, MO.—The Novinger Telephone Company was incorporated August 10, with a capital stock of $2,400. The incorporators are W. F. Niece, F. M. Gilliland, H. C. Truitt, Phil. Weber, J. B. Kriner and others.

ST. LOUIS, MO.—The American Phantom Circuit Telephone Company filed articles of incorporation last week with a capital stock of $10,000, full paid. The incorporators are: R. C. Stubbs, E. H. Cary, of Dallas, Tex., and Joseph R. Lowry, St. Louis.

HUNTINGTON, NEB.—The Cedar County Farmers' Telephone Company has been formed with a capital of $5,000.

STEUBENVILLE, OHIO.—A new automatic telephone exchange will be installed here by the Phoenix Company. The cost will be about $20,000.

TOLEDO, O.—An appropriation of $200,000 for extensions and reconstruction has been made by the Central Union Telephone Company for Toledo. Most of the money is to be expended in outside construction. In addition to considerable extension work in the way of poles, conduits and cables some of the older circuits are being rebuilt.

TEDDA, OKLA.—The Caddo Telephone Company has been incorporated by George H. Studebaker and Ora H. Studebaker. The capital stock is $5,000.

BAKER CITY, ORE.—On account of the present inferior telephone service, prominent business men contemplate the early organization of an independent telephone company.

DECORAH, PA.—The Bell Telephone Company has been installing a new exchange in Decorah. According to Mr. O'Rourke, the superintendent, this exchange connects with three hundred farmers adjacent to Decorah, and they have a connection with more than eighteen hundred independent telephones in his district.

PLANKINTON, S. D.—A new telephone company has been organized here with T. W. Taubman secretary and R. C. Drake treasurer.

HUMBOLDT, S. D.—The Humboldt, Hartman & Wellington Telephone Company has been incorporated. Capital, $10,000. Incorporated by John Hartman and Geo. W. Ingalls.

NASHVILLE, TENN.—At the last meeting of the City Council, permission was asked to withdraw the telephone measure granting to C. A. Thatcher and Ernest Mitchell a franchise in the city to operate a telephone system.

Councilman John Langham made the request, as he had introduced the measure, but as the unanimous consent of the Council has to be secured before a measure is withdrawn, the bill was killed on second reading. Councilman A. B. Anderson objected to its withdrawal, and stated that it would be a good time for the Council to again go on record as opposed to two telephone systems in Nashville. Councilman Canfield said that he was also opposed to the withdrawal of the bill, as there had been considerable time spent on the matter. The bill was, therefore, rejected.

TIMPSON, TEX.—The Timpson Telephone Company has been organized here. J. B. Bussey is one of the incorporators.

SHERMAN, TEX.—The North Texas Telephone Company has been organized here. It has a capital stock of $10,000. The incorporators are R. J. McHugh, of Fort Worth; S. W. Poerter and S. D. Donoho, of Sherman.

DALLAS, TEX.—The Southwestern Telegraph & Telephone Company is making improvements to its telephone systems in Cleburne. Laredo and other towns of the State. The long-distance system is being extended to Rockport, Ingleside, Portland, San Diego and other places.

MONTELL, TEX.—The Citizens' Telephone Company has been organized at Montell to operate a system from Uvalde to Barksdale. A. S. Baylor, T. S. Sutherland, James Whitecotton, L. V. Wallace and Travis F. Jones are the incorporators. It is an independent company.

SAN ANTONIO, TEX.—It is stated that the matter of enlarging the telephone system of the San Antonio Telephone Company will be considered at the coming meeting of the board of directors. D. A. Walker, of Columbus, Ohio, is president of the company, which is an independent concern.

AUSTIN, TEX.—The Commercial Telephone Company, of Texas, was sold at auction here Aug. 2 for $110,000, being bought in by a committee representing the bondholders. The sale resulted from a suit of the stockholders to secure on $400,000 of bonds, which is said to have been defaulted. Extensive additions are announced by the new management.

PARK CITY, UTAH.—The Utah Independent Telephone Company has purchased a site here for the erection of an exchange building.

LYNCH'S, VA.—Lynch's Telephone Company has been formed. Incorporators: W. Fauntleroy, president; W. S. Frazier, secretary and treasurer; W. T. Webb, general manager, all of Lynch's, Va. Capital stock, maximum, $5,000.

KAUKAUNA, WIS.—Work on the new telephone exchange to be installed in this city by the Fox River Valley Telephone Company will be commenced next week.

NEENAH, WIS.—The Wisconsin Telephone Company has decided to lay an underground system not only along Commercial Street north from Wisconsin Avenue, but all along Wisconsin Avenue. A new switchboard has been ordered and a new telephone exchange will be built.

CRANDON, WIS.—The stockholders of the Crandon Telephone Company have met to do preliminary work necessary to organize the company. The directors elected were W. W. Waite, Egbert Wyman, J. L. Haile, C. O. Decker and S. A. Gifford. The directors have elected the following officers: J. L. Haile, president; W. W. Waite, vice-president; E. Wyman, secretary; S. A. Gifford, treasurer.

CHEYENNE, WYO.—The Bell Telephone Company will soon inaugurate improvements in its system here at an estimated cost of $20,000.

Electric Light and Power.

CITRONELLE, ALA.—This town desires a promotor to furnish electric lighting to the town. Address H. A. Healy, commissioner of electric light.

OPELIKA, ALA.—The capacity of the Opelika Electric plant is to be increased to furnish power for the street railway, light and power to Opelika and Auburn. Capital, $300,000.

DARDANELLE, ARK.—Bonds have been sold by the city for an electric light plant, and the building of the plant is to be started immediately.

SAN FRANCISCO, CAL.—Chas. C. Moore & Co. were awarded the San Luis Obispo Gas & Electric Company's contract for a complete steam plant. The National Electric Company will supply a 200-k.w., 3-phase belted generator. Babcock & Wilcox boilers and Peabody oil burners are included.

LITCHFIELD, CONN.—The new power plant of the Litchfield Electric Light & Power Company, in the village of Bantam, is making great progress. Lines are being strung to the surrounding towns of Litchfield, Washington, Washington Depot and New Preston, and there is reason to believe that Milton, Morris and Bethlehem will soon be lighted from this power. The electric plant and power house are neat and well equipped and appointed. Nutting & Turkington, electrical engineers, of Litchfield, have contracted with the company to operate the plant for a stated price per year.

FARMINGTON, CONN.—Civil Engineer H. T. Keith, of Mt. Washington, has been working on the engineering problems of the proposed development of the river for transmitting electric power. He asserts that the project now stands on a solid basis, that about $100,000 has been subscribed by Hartford and Boston capitalists. It is planned now to build the dam over the Sandisfield line, or a half mile beyond the Otis southern border. The dam will be forty feet high and an iron tube will run from it four miles down the river to New Boston, where the power house will be built. The fall is 80 feet to the mile, in one of the miles 100 feet, so that the total fall will be nearly, if not quite, 350 feet. Including with this the power collected at the dam itself, the total horse-power to be developed will be between 4,500 and 5,000. This will be transmitted electrically to Hartford and Springfield for lighting.

LA GRANGE, GA.—Bids will be received until September 5 by the electric light commission for all machinery and construction work and building for a complete electric light plant.

DUBLIN, GA.—The City authorities are preparing to extend and greatly improve the electric light system of the city. Negotiations have been entered into with the Fort Wayne Electric Works by which the system of the city will be changed from a high to a low frequency. The present arc lights in the city will be taken down and inclosed arcs will be substituted. At present there are 2,300 incandescent lights in the city. The new system will provide for an increase of 700.

SUGAR CITY, IDAHO.—The Fremont County Light & Power Company has been organized here, with a capital stock of $25,000. James Siddoway, of Teton City, is president of the organization.

FREEBURG, ILL.—The Village Board has decided to erect a $10,000 municipal lighting plant.

EAST ST. LOUIS, ILL.—The Citizens' Electric Light & Power Company has let the contracts and work will soon begin upon improvements in the lighting system on the East Side, which will cost an aggregate of $150,000. The entire system of wiring in the city will be changed, much of it being taken down. The three-phase system is to be established. Cables of 500,000 circular mills will take the place of 14 and 16 wires now in use along the principal streets.

DANA, IND.—The citizens have voted to install an electric light plant.

CONNERSVILLE, IND.—The McFarlan Carriage Company has arranged to use electricity as a power in place of steam. Sanborn & Marsh, electrical engineers and contractors, of Indianapolis, are equipping the factory with ten motors. One dynamo will furnish the power for the several motors to be installed. This machine will have a capacity of 125 hp.

DECORAH, IA.—F. M. Hughes, City Clerk, states that the citizens on August 15 voted to grant a franchise to the Decorah Electric Light Company.

SPIRIT LAKE, IA.—Municipal ownership at Spirit Lake has proven a failure and the water works system and electric lighting plant are to be turned over to a private concern. With this end in view a special election will be held Aug. 19 to grant a franchise to the parties who will take over these public utilities for a term of twenty-five years.

CAMPBELLSVILLE, KY.—J. L. Atkinson, president Campbellsville Lighting Company, states that the construction of the new plant will be under the supervision of Mr. B. S. Kincort, Supt. The company will expend about $5,000.

ARCADIA, LA.—A company has been organized here with a capital of $5,000, with J. L. Dalton as president and M. L. Tooke as secretary and treasurer. The company has bought the Dalton-Lord electric light plant located here and will make considerable improvements and additions.

AUBURN, ME.—The Lewiston & Auburn Electric Light Company has made a five-year contract with the city to light the streets. The city agrees to pay to the company monthly for said lighting service, at the rate of $55 per year for each arc lamp and $12 per year for each incandescent lamp.

BALTIMORE, MD.—Current has been turned on in the big new power station at South Baltimore, which will furnish electric light and power under the franchise of the Maryland Telephone and Telegraph Company. The company starts off with about 1900 subscribers for 96,000 lights of 16 cp.

HOLYOKE, MASS.—The City electric light station is to be reconstructed, enlarged and extended.

SPRINGFIELD, MASS.—The Hampden Electric Company has purchased a large part of the Westfield Little River basin with the ostensible purpose of developing a big power plant on the river. A right has also been secured to erect and maintain transmission lines.

CAMBRIDGE, MASS.—The Cambridge Electric Light Company will put into effect a reduction in its tariff to customers on Oct. 1, 1905. The basic rate will be changed from 16⅔ cents to 15 cents per kilowatt-hour, and will allow a reduction of 10 per cent for prompt payment, making the net price 13.50, as compared with a net price heretofore of 14.17 cents. The company will supply free renewals of lamps.

MARINE CITY, MICH.—The Edison Electric Light & Power Company, of Detroit, is securing franchises between Detroit and tnis city. There may be some trouble at Algonac and St. Clair as each has a municipal plant.

HART, MICH.—The Hart Common Council has granted a 10-year franchise to the Pere Marquette Light & Power Company for furnishing current to that village. The company will dam Ruby Creek, build a turbine plant and furnish light and power for Pentwater, Hart and Shelby. The contract here will provide for the renting by the company of electric outfits from the switchboard out for a term of 10 years, current to be furnished for street lighting at 6 cents per kw.-hour.

MONROE, MICH.—The City Council Aug. 10 passed a resolution for the sale of the municipal lighting plant to the General Constructing Company, Ltd., for $25,000, including a 10-year contract and franchise for lights at $56 per year. Both the sale and contract will have to be ratified by the people at a special election. Geo. T. Wolf, of Three Rivers, is one of the stockholders of the company.

COLUMBIA, MO.—Columbia has voted to issue $10,000 worth of bonds for the construction of improvements to the water and light plant, which has been owned by the city for two years. This issue is in addition to a $100,000 issue at the time the plant was bought. The municipal experiment is said to have been very successful in Columbia so far.

KANSAS CITY, MO.—The Kansas City Electric Light Company will lay down new conduits.

HELENA, MONT.—Samuel T. Hauser, of Helena, formerly governor of Montana, states that it is proposed to construct a dam over the Missouri River to furnish Helena and Anaconda with electricity.

MEREDITH, N. H.—The Meredith Electric Light Company has been sold and an entirely new management has control, J. A. Rodgers, of Providence, being the present manager and secretary.

GORHAM, N. H.—The new lighting rates of the Cascade Electric Light & Power Company went into effect August 1. There is much kicking at the increase in the cost of lights on the flat rate. In some cases the increase will amount to over 75 per cent. Many people are having meters installed.

GORHAM, N. H.—Work has been started on a water power plant on Mr. McMillan's farm, Shelburne, using the Androscoggin River. Mr. Fred G. Stuart, of Gorham, has the contract to do the carpenter work and build the head gate, tail race, etc. The power is to be used for the generation of electricity.

NUTLEY, N. J.—The Town Council has granted a 4-year contract to the Public Service Corporation for the lighting of the streets of the town at $16 per lamp per year.

CAMDEN, N. J.—The Wyoming Gas and Electric Company has been formed in Camden, N. J.; capital, $15,000. Incorporators, John A. MacPeak, William F. Eidsell, F. R. Hansell.

RENO, NEV.—The sale of the Reno Power, Light & Water Company to Brown, Engenger & Co., of San Francisco, which had an option on both the Reno and the Washoe Lighting & Power Companies, has been announced.

SYRACUSE, N. Y.—The City of Syracuse is soon to award a new contract for its municipal lighting. The Syracuse Lighting Company, which has the present contract, has a monopoly of the business in Syracuse and is the only prospective bidder. There is some opposition to this condition, however, and there is agitation in favor of making municipal ownership of the lighting business an issue in the approaching city election campaign. Last year the Syracuse Lighting Company was paid $128,155.41 by the city. It is announced that the Niagara, Lockport & Ontario Power Company will deliver power in Syracuse by next March, the power to be supplied by the Ontario Power Company's plant on the Canadian side of the Niagara River and transmitted across the State over the West Shore Railroad right of way. Although the main purpose of the company in delivering power at Syracuse is for the use of the New York Central-Andrews syndicate in the operation of electric cars, there is a possibility that the company will secure a franchise so as to be able to enter the electric lighting field in Syracuse.

FAYETTEVILLE, N. C.—It is proposed to expend about $20,000 on the municipal electric light plant and line extension, the work to include the installation of two boilers of 300-hp., one or two engines, a 250-kw. alternator and two 120-kw. generators. Mr. W. T. Jones is superintendent.

GALION, OHIO.—The Crawford County Gas & Electric Company intends constructing a new power house here at a cost of $40,000.

TIPTON, ORE.—W. A. McNaughton, of Tipton, is arranging for the construction of an electric power plant on Strawberry Creek.

ALEXANDRIA, PA.—The Juanita Light & Power Company has been incorporated. Capital, $10,000.

PHILADELPHIA, PA.—The Philadelphia Compress Electric Light & Ice Company has been formed with a capital of $30,000.

PHILADELPHIA, PA.—The Philadelphia Electric Company bid on August 15 for furnishing electric arc lights for the year 1906, $99.42 per light per year (average); total cost, $1,073,272.

DOYLESTOWN, PA.—By order of the Court, the Bucks County Trust Company, trustee under the mortgage, has sold to R. D. Brown all the property and franchises of the Standard Telephone & Telegraph Company. The price paid was $50,000.

McCALL FERRY, PA.—A mortgage of $10,000,000 has been filed in the Recorder's office at York to secure a bond issue for the McCall's Ferry Power Company, which proposes building a power plant on the lower Susquehanna River, near McCall Ferry. The Knickerbocker Trust Company, of New York City, is reported to be named as the trustee for the stockholders.

COLUMBIA, S. C.—The Columbia Electric Street Railway, Light & Power Company proposes to install a 240-kw. rotary converter.

ANDERSON, S. C.—The Hatton Shoals Company has been organized with a capital of $150,000 to develop 5,000 horse-power on Tugaloo River, 16 miles east of Anderson. A. T. Smythe, of Charleston, is one of the directors. R. S. Ligon is president of the Company.

ANDERSON, S. C.—The stockholders of the new Hatton's Ford Power Company at Anderson recently met and organized by the election of a board of directors, who then chose officers, with R. S. Ligon, of Anderson, president. It is estimated that 6,000 horse-power is available at the shoals to be developed. The company is capitalized at $150,000 and will offer power for light and manufacturing purposes.

CLARKSVILLE, TENN.—The Queen City Electric Light & Power Company proposes to install a 500-kw. Curtis turbine, a 200-kw., 3-phase alternating-current generator, a 250-kw. motor-generator set, a new switchboard, three water-tube boilers, etc.

HOUSTON, TEX.—The San Saba Light & Ice Company has increased its capital stock from $15,000 to $20,000.

JEFFERSON, TEX.—The Jefferson Ice, Light & Power Company has decided to construct an electric light plant.

SAN ANTONIO, TEX.—The San Antonio Gas & Electric Company proposes to install a 500-kw., alternating-current generator.

DALLAS, TEX.—The Dallas Electric Light & Power Company will erect an electric light plant, the cost to be about $500,000.

SAN ANTONIO, TEX.—C. A. Zilker, of Bloomington, Ill., is promoting an organization with a capital of $500,000, to build an electric light plant.

SALT LAKE CITY, UTAH.—The County Commissioners have granted Emil J. Raddatz a franchise to construct and operate an electric transmission system to Bingham Junction and Sandy.

OGDEN, UTAH.—Oregon Short Line officials contemplate the early construction of an electric plant, which will furnish power for the entire railroad system of the city. An order for needed equipment will be placed within the next few weeks.

ST. JOHNSBURY, VT.—The St. Johnsbury Electric Company has closed all contracts for improvement to its plant.

RADFORD, VA.—The Grason Electrical Corporation will build a power house at Graysontown, 8 miles from Radford, and will light the towns of Christiansburg, Childress and Riner, furnish power for a contemplated line from Cambria to Christiansburg, and to factories. Guy Grayson is president and W. C. Grayson, vice-president.

BLAINE, WASH.—The Blaine General Electric Company has been incorporated with a capital of $50,000.

PULLMAN, WASH.—Extensive improvements are to be made to the city electric light plant. D. F. Staley is mayor, and H. V. Carpenter, chairman electric light committee.

LOOMIS, WASH.—Mr. John Boyd is pushing work on the tunnel project of the Palmer Mountain Tunnel & Power Company, for which the initial plant is to be driven by a 750-hp. turbine, already ordered. The current is needed for the development of mining in the vicinity.

BURLINGTON, WIS.—The citizens have voted to raise $12,000 for a municipal electric light plant.

JANESVILLE, WIS.—The Janesville Electric Company proposes to extend its system to Milton and Milton Junction. P. H. Korst is manager.

PRINCETON, WIS.—The citizens on Aug. 5 voted to issue $12,000 bonds to purchase the plant of the Citizens Electric Light & Power Company.

PLATTEVILLE, WIS.—The Platteville Electric Light & Power Company will, this fall, add a 50-kw. generator and a 80-hp. engine, direct connected. Early in the year 1906 the company contemplates installing machinery to double the present capacity of the plant. J. H. Evans is secretary.

MADISON, WIS.—The State Board of Control is considering the construction of an electric light plant at the Mendota State Hospital, to cost about $17,000.

FLORENCE, WIS.—The Pine River Improvement & Power Company has been incorporated with a capital of $100,000 by E. W. Hopkins and E. A. Edmunds.

FOND DU LAC, WIS.—The Independent Light, Heat & Power Company has been incorporated with a capital of $25,000 by Robt. R. Freeman, G. R. Hoffman and Frank D. Fulton.

LARAMIE, WYO.—The franchise of the Laramie Electric Light & Fuel Company has been revoked and a franchise granted to an Indianapolis firm represented here by W. E. Sterne of Littleton, Col.

VICTORIA, B. C.—The citizens have voted to issue $11,000 bonds for the purpose of increasing the capacity of the electric light plant.

LAS VEGAS, N. M.—The City Council has granted a 50-year franchise for street railways and electric lights to Wm. A. Buddecke, of St. Louis, Mo., owner of the present electric railway system. Extensions to the system to cost $15,000 have already begun.

ST. MARYS, ONT.—The citizens have voted to issue $15,000 bonds for the extension of the electric light plant and water works.

NAPANEE, ONT.—Mr. Kelch, of Montreal, Que., is preparing plans and specifications for the proposed electric light plant, to cost about $35,000.

MEAFORD, ONT.—The ratepayers of the town of Meaford will vote on a by-law to raise $12,000 by debentures for the purchase of the electric light plant, to install machinery and to purchase power from the present company to operate the plants. There is much opposition to municipal ownership.

WINDSOR, ONT.—Under the name of the Detroit River Tunnel Company, the Canadian Tunnel Company and the Michigan Tunnel Company have combined. This was effected at a meeting held at Windsor, Ont., and the companies were combined in order to expedite the actual work of construction. The new company is capitalized at $3,000,000, which is merely a nominal figure. Chief Engineer W. S. Kinnear, of Michigan Central, is in charge of the enterprise, and has appointed B. Douglas tunnel engineer, J. C. Mock electrical engineer and A. C. Everham terminal engineer.

ST. CATHERINES, ONT.—Mr. Frederic Nicholls, president of the Toronto Niagara Power Company, and Col. Pellatt, a director, recently visited the city of St. Catherines, and disclosed to the Mayor and several of the City Aldermen a plan of mammoth railway development in the Niagara Peninsula, which the company has mapped out, and which, when carried out, will make St. Catherines one of the greatest electric railway centres on the continent. The company will build electric lines between St. Catherines and Stony Creek, connecting with Hamilton and eventually Toronto, while the main line will run from Stony Creek to Buffalo.

OTTAWA, ONT.—It is understood that the officers of the Canadian Pacific Railway are considering the advisability of utilizing electricity, instead of steam, in the operation of their trains on the boundary system in British Columbia. An electrical company in the Pacific province is making preparations for the development and supply of electricity along Kootenay River, for the operation of mines and smelters. The officials will first make a test of electricity for haulage power on an extensive scale for heavy grades on Rossland Hill, and if it proves satisfactory, the company's boundary lines will be operated by electricity in the future.

WESTMOUNT, QUE.—Improvements are to be made here at a cost of $200,000, including the construction of an electric light plant. Ross & Holgate, of Montreal, Que., are the engineers in charge.

The Electric Railway.

HOLLISTER, CAL.—The purchase of a large power plant on the Tuolumne River has just been made from which power will be brought to run the projected Kemp Van Ee Electric Railway from Santa Cruz to Hollister and to the cement works in San Juan Valley. The plans of the syndicate are about completed, and it is said that in a few weeks a crew will be set to work laying rails and erecting necessary buildings. The power plant will cost $500,000.

NAPA, CAL.—The complete street car service is soon to be inaugurated in Napa, Cal., all cars starting from Lincoln Avenue, that city, and making connections at the depot in East Napa for Vallejo. Six round trips will be made daily between Napa and San Francisco, passengers taking boats at Vallejo to connect for San Francisco. In a few weeks work will be completed, extending up the valley to St. Helena and Calistoga. This is the first single-phase electric railway on the Pacific Coast.

ROCKVILLE, CONN.—The work of building the Rockville, Broad Brook & East Windsor Street Railway is now well under way. The road will connect with the Hartford, Manchester & Rockville trolley line at West Street in Rockville, and the cars will be run to the Market Street terminus over their tracks. The Rockville & Broad Brook Company has a traffic agreement with the Hartford, Manchester and Rockville Company for twenty-five years. This arrangement will compel the Hartford & Manchester Company to increase its motive power.

EAST ST. LOUIS, ILL.—The Marion & Johnson City Railway Company, with its principal office at East St. Louis, has been incorporated with a capital stock of $10,000. The incorporators and first board of directors are W. S. Forman, H. K. Browning, Fred Pausch, C. M. Forman and J. E. Walker, all of East St. Louis.

ALGIERS, LA.—The New Orleans Railways Co. will lay a number of cables across the river for the purpose of furnishing lights to Algiers.

BANGOR, ME.—The annual meeting of the stockholders of the Bangor Railway & Electric Company has been held. The directors chose officers as follows: John R. Graham, president; Frank Silliman, vice-president; F. L. Oliver, treasurer; George T. Sewall, of Old Town, clerk; and C. A. Pearson, Jr., auditor.

BANGOR, ME.—At the annual meeting of the stockholders of the Bangor & Northern Railroad, formerly the Penobscot Central, the following officers were chosen: John R. Graham, president; Charles F. Woodard, vice-president; E. C. Ryder, clerk; F. D. Oliver, treasurer; John R. Graham, Charles F. Woodward, Charles D. Stanford, Charles V. Lord and Franklin A. Wilson, directors.

MENOMINEE, MICH.—Articles have been filed with the Secretary of State of Michigan incorporating the Menominee & Escanaba Railway Company, which proposes to build an electric line connecting the cities of Menominee, Menominee County and Escanaba, Delta County. The capitalization is $300,000. Construction will be started next spring. The line will follow as nearly as practicable the Chicago & Northwestern road.

JEFFERSON CITY, MO.—The Kansas, Lee's Summit & Eastern Electric Railroad has been chartered, with a capital stock of $750,000. The following are the incorporators: J. J. Apperson, L. W. Branham, W. A. A. Summitt and others.

SYRACUSE, N. Y.—The Syracuse Northern Traction Company has been incorporated with a capital stock of $1,000,000 to take over the interests of the Syracuse & South Bay Railroad Company, and also the rights and franchises of the old Oneida Lake Railroad Company, and to provide for the extension of the line now in course of construction between Syracuse and Oneida Lake to Brewerton, Bridgeport and Shackelton's Point. The incorporators of the company are H. H. Plumb, W. K. Niver, W. B. Burns, G. D. Chapman, W. R. Kimball, F. L. Barnes, G. T. Skiff, W. M. Brown, C. N. Watson, L. L. Waters, F. T. Pierson, C. A. Bridgeman, E. G. Connette, G. C. Towle and D. E. Balsley.

RENO, NEV.—The construction of an electric railway from this city to Lake Tahoe, a distance of about 25 miles, is being advocated by local capitalists, who have already had preliminary surveys made. It is planned to secure power from a point on the Truckee River not far distant from Reno.

YOUNGSTOWN, OHIO.—The long-talked-of consolidation of the Pennsylvania & Mahoning Valley Railway with the Youngstown & Sharon Railway & Light Company is about to be consummated. It is understood that E. N. Sanderson, of New York, will be president of the consolidated company, which will control a large interurban system and all the gas and electric lighting systems of Warren and Youngstown, O., and Sharon, New Castle and Greenville, Pa.

HARRISBURG, PA.—The Cherry Tree & Indiana Street Railway Company, with a capital stock of $120,000, has been chartered to build 22 miles of line in Indiana County. T. D. Davis, of Indiana, is president.

WESTMINSTER, S. C.—The Oconee County Railway Company proposes to build an electric railway from Westminster or Seneca, S. C., to Townville and Fair Play, S. C. The line will divide at Oakway, with one branch via Tokeena to Townville, and the other via Tugaloo to Fair Play. It will be 24 miles long. J. J. Haley, of Westminster, is interesed.

SARATOGA, WYO.—A company will be formed here for the purpose of building an electric railway from this city to Walcott. Power for the purpose will probably be secured from the North Platte River. Capital for the enterprise is to be raised by local subscription.

MONTREAL, QUE.—It is stated that the Montreal & Southern Counties Railway Company has obtained right of way over the Victoria Bridge and will now proceed with the construction of an electric railway between this city and Longueuil.

New Industrial Companies.

THE MAGNETA COMPANY, of New York, has been incorporated to manufacture clocks; capital, $50,000. Directors: William Hommel, Thomas Morgan and William D. Moore, New York.

THE RIVAL ELECTRIC COMPANY, of Knoxville, Tenn., has been formed. G. E. May is general manager, and Guy Helmer is secretary-treasurer. The company will do a general electrical contract work.

THE BURN-PETERIT MANUFACTURING COMPANY, with a capital of $300,000 paid in, at New Haven, Conn., will make gas and electric lighting fixtures and will occupy a portion of the plant of the W. S. Burn Company in Fair Haven.

Legal.

TELEPHONE CONDUIT NEGLECT.—In the appeal to the Supreme Court of Pennsylvania of the defendant in the case of White vs. Keystone Telephone Company, of Philadelphia, the judgment below was affirmed. The plaintiff was injured by falling, after dark, over a pile of paving stones that had been left on the sidewalk of a dimly lighted street. The sidewalk was three feet wide the pile of stones a foot high and no means were taken to give notice of the obstruction. The only question raised by the assignments of error was whether the case should have been withdrawn from the jury because of the failure to connect the defendant with the commission or the negligent act. It appeared from the plaintiff's testimony that a few days before the accident the defendant secured a permit to lay conduits on the street, and had begun the work, and was occuping the street for that purpose; that on the day of the accident the paving stones had been removed from the cartway and piled on the pavement, the conduits laid, and the trench refilled with earth; that on the morning after the accident the same workmen who had removed the stones from the street and piled them on the pavement, placed them back on the street. While there was no direct proof that the stones were piled on the pavement by the defendant's workmen, the circumstances shown reasonably led to that conclusion, and excluded any other conclusion equally reasonable. There was sufficient evidence to make out a prima facie case.

SAFEGUARDS IN TROLLEY BARNS.—In the appeal of the defendant in the case of Young vs. People's East Electric Company, the Supreme Court of Iowa has sustained the decision of the lower court. The defendant corporation operates a street railway system in the city of Burlington, Iowa. By arrangement between said railway company and the Post-Office Department of the United States, mail boxes are attached to appellant's cars for the reception and transportation of mail deposited therein. At certain intervals a carrier in the postal service is required to visit the central barn or shed in which the cars are stored and collect the mail from the boxes, a duty which at the time of the accident complained of was being performed by the plaintiff. On the evening of the 12th of November, 1902, the plaintiff went to the car barn, and in attempting to reach a car standing some distance within the door, fell into a pit or opening in the floor, and was thereby injured. It is alleged that the defendant was negligent in having placed on the car track a block from which a spike protruded and over which plaintiff claims to have stumbled into the pit. It is also alleged that the pit was usually kept covered, affording a safe way over which plaintiff had been accustomed to pass, but that on the night of the accident it had been negligently left uncovered, and, the barn being dimly lighted, plaintiff was thrown into the opening without fault on his part. The defendant denied all charges of negligence on its part, but the court held otherwise.

Obituary.

MR. L. A. SOMERS.—L. A. Somers, a veteran telegraph man, died at the home of his son in Cleveland, O., on August 17, of dilatation of the heart. He was sixty-six years old. He had been connected with the telegraph industry practically since its inception, having been associated with J. H. Wade, Anson Stager and other well-known Western Union officials. Mr. Somers was chief operator of the Government War Department telegraph, controlling the telegraph service in the Civil War, with headquarters at Washington. For the last thirty years he had lived in Cleveland, and had been the manager of the gold and stock department of the Western Union Company in that city and nearby places for many years.

Educational.

UNIVERSITY OF ARIZONA.—The University has recently issued an attractive booklet illustrating the interior and exterior of the various buildings located upon the campus. The University, which comprises a college of agriculture and mechanical arts and a school of mines, is located at Tucson, Arizona, at an elevation of 2,400 feet, where it is stated the climate is remarkably mild, dry and healthful. Tuition is free to residents of Arizona, a moderate charge being made to non-residents.

THE WORCESTER POLYTECHNIC INSTITUTE, of Worcester, Mass., has announced the establishment of a chair of electrical railroad engineering. To take charge of this branch of the instruction, Mr. Albert Sutton Richey, chief engineer of the Indiana Union Traction Company, has been elected a member of the faculty, his title being assistant professor of railroad engineering.

Personal.

MR. P. A. VALENTINE, of the Armour interests, is said to be slated as the new president of the Illinois Tunnel Company of Chicago, which has now such an extensive freight subway system there.

MR. JACOB CLOOS consulting electrical and mechanical engineer at Milwaukee Wis., has his headquarters there at 605 Matthews Building. He has also opened a branch office at 1408 Berlin Street, La Crosse, Wis.

MR. W. McBRIDE, sales agent of the Standard Underground Cable Company has become president of the Fort Pitt Spring & Manufacturing Company, with headquarters from September 1 in the Farmers' Bank Building, Pittsburg.

MR. E. H. DAVENPORT, an old telephone man, who has lately been connected with the Norwalk (O.) *Evening Herald*, has gone to Columbia City, Ind., to take the position of manager of the Whitley County Telephone Company, an independent system with several exchanges.

MR. ROBERT R. LIVINGSTON has accepted a position with the Engineering Company of America, and will make his headquarters at 74 Broadway, New York. He was formerly connected with the Allis-Chalmers Company and more recently with Mr. W. S. Barstow in electrical engineering work.

MR. C. A. COFFIN, president of the General Electric Company, has, we regret to say, been suffering from a quite severe attack of inflammatory rheumatism at his home in Lynn, Mass., the attack being intensified by hay fever. With his wonted resilience, however, Mr. Coffin has made a rapid recovery and is reported much better.

PROF. H. S. CARHART, on his way to the British Association meeting in South Africa, was last heard of from Madeira on board the Union steamer Saxon, August 1st, when he reported Prof. Perry, Prof. Darwin and Sir W. and Lady Crookes in the jolly party all doing well, and to use his classic Britticism, having an "elegant time."

MR. HERBERT FLEISHHACKER, of San Francisco, who is the secretary of the American River Electric Company and the Truckee River General Electric Company, was married Aug. 9 to Miss May Greenebaum, daughter of Sigmund Greenebaum, of the London, Paris & American Bank. Mr. and Mrs. Fleishhacker will spend their honeymoon in Europe.

MR. JOHN J. MOORE.—Mr. John J. Moore has become identified with the United States Light & Heating Company in which he will represent the Starbuck and Hawley control. Mr. Moore was identified, years ago, with the car-building industry and at a later period with various lines of electrical development, including pioneer work in establishing electric lighting in New York City and State. The busines of the company, whose affairs Mr. Moore will watch, is the lighting and heating of railroad cars by electricity. Mr. Moore is one of the best known of the early Thomson-Houston representatives.

MR. H. B. SALE, the new vice-president of the Indianapolis Telephone Company and general manager of that company and of the New Long Distance Telephone Company, has given his entire attention to the two companies during the six years of their existence. Having then had considerable experience in practical telephone management, he was elected secretary of the two companies on their organization, and later secretary and treasurer. He is familiar with the entire business of the two companies and also with the telephone situation all over the state. He has been prominently identified with the work of the national association. He is a man of active mind, great energy and fine business ability and is recognized as one of the best posted men on telephone affairs in the entire country.

MR. LOUIS HOLLWEG, who was elected president of the New Long Distance Telephone Company and of the Indianapolis Telephone Company, to fill the vacancy so tragically created by the sudden death of Mr. Sheerin, is now devoting his entire time to the telephone business. He is giving the business the same thorough attention that has contributed to his success in other lines. Mr. Hollweg has been prominently identified with the business of Indianapolis and of Indiana for many years. He acceded to the unanimous wish of the directors of the local and long-distance telephone companies to become the active president of each and to give his time and attention to the telephone business. He is a man of pleasing personality as well as of marked busines ability. He is the head of the great importing and wholesale queensware house of Hollweg & Reese.

MR. HOWARD S. REYNOLDS, superintendent of the operating department of J. G. White & Company, of New York, has resigned to assume the management of the electric light, street railway and gas properties in Helena, Mont., recently acquired by the White Company and allied interests. Mr. Reynolds graduated from the Massachusetts Institute of Technology in 1894 with the degree of B. S., and in 1895 was with the Lowell, Lawrence & Haverhill Street Railway, after which he was with the Boston Elevated Railway and the Brockton Street Railway, in various capacities. For six years he was with Stone & Webster, first as a draughtsman and street railway construction superintendent and later as manager of their electrical and gas properties in Columbus. He then resigned to become associated with J. G. White & Company.

MR. W. S. DORAN.—One of the most pleasant valedictory dinners among the electrical fraternity of London was that given to Mr. W. S. Doran on the occasion of his leaving England to return to the United States, by about a hundred of his confreres in the British Westinghouse Company and other friends. The dinner was held in the large banqueting hall of the Hotel Cecil and was a huge success in every way. Mr. Doran, who is well known both in America and England, started his career with the Southwark Foundry & Machine Company, of Philadelphia, being afterwards connected with the United Gas Improvement Company, also of that city as manager of gas plants. In 1888 he entered the employment of Henry R. Worthington, of New York, doing much good work for the Navy and Army Departments. In 1892, he was made general supervising agent of the Worthington branch offices, and was in full charge of all the selling business of the Worthington Company in the West, with headquarters at Chicago. Mr. Doran went to England in 1899, for the Worthington Pumping Engine Co., in London, and in 1901 he joined the British Westinghouse Company, paying special attention to the organization of the branch offices, and also looking after important contracts with the railway companies and other corporations. Two of the more important contracts of this character which he has been successful in concluding being the complete installation of the power and lighting system at the Midland Railway Company's Heysham Harbour plant, and the contract for all the electrical apparatus for the corporation of Belfast tramway system. Mr. Doran has been appointed manager of the power department of the Allis-Chalmers Company, and will hereafter have his headquarters in Milwaukee. He has proved one of the most successful of the many American engineers who have gone over to England, and will be regretted by many friends whom he has made there, having established for himself a popularity with British engineers of a lasting character. He returns to the United States with the good wishes of all his friends, and is a very valuable acquisition to the staff of the Allis-Chalmers Co.

Trade Publications.

DRUM STRANDING MACHINES.—The Alton Machine Company, 126 Liberty Street, New York, has issued Bulletin No. 62, illustrating a new type of drum stranding machine carrying 18 drums.

TELEPHONE SPECIALTIES.—The Yonkers Specialty Company, in its latest catalogue, illustrates the Metropolitan cable clip, the New York ground clamp and the Metropolitan expansion plug for making attachment to walls.

COFFEE MAKING BY ELECTRICITY.—In an artistic little pamphlet the General Electric Company describes and illustrates in detail an electric percolator for making coffee, by means of which it is stated the most delicious coffee can be prepared in a few minutes.

TAPES, COMPOUNDS AND RUBBER GOODS.—The Clifton Manufacturing Company, Jamaica Plain, Mass., in a recent publication, gives a descriptive list of the long line of insulating tapes and compounds and rubber goods of its manufacture. The Clifton iron conduit is also noticed.

THE LORD ELECTRIC COMPANY, Boston, Mass., in Bulletin C, just issued, illustrates various forms of Shaw non-arcing lightning arresters, which it manufactures. A good description is given of the principle of construction of this arrester. The Shaw non-arcing static discharger is also described and illustrated.

GAS PRODUCER.—The Morgan Construction Company, Worcester, Mass., has issued a 50-page pamphlet, printed on coated paper and handsomely illustrated, describing in full detail the Morgan continuous gas producer. The various details of the apparatus are illustrated and a number of views given of gas producer plants installed and now in operation.

REFRIGERATING MACHINERY.—The De La Vergne Company is sending out two handsome folders relating to its refrigerating apparatus. Aside from the interest of the text, those who get up trade literature will appreciate the very effective design of the folder, which can scarcely fail to cause it to be taken up for examination by those who find it on their desk.

MARSH BOILER FEED PUMPS.—The American Steam Pump Company, of Battle Creek, Mich., has issued a pamphlet describing its line of Marsh boiler feed pumps. Almost a score of different types are illustrated and very complete descriptions and data given. Cross sectional and detail cuts show very clearly and fully the design and construction of the pumps.

THE INTERNATIONAL TELEPHONE MANUFACTURING COMPANY, of Chicago, reports a constantly increasing demand for its transmitter, especially for toll line switchboard use and for long-distance service. These transmitters, provided with especially prepared granular carbon, have a very strong, clear and natural tone, and do not "fry" or "pack" from usage.

THROUGH MATTER TO MIND.—Mr. W. H. Mallock is a brilliant and illuminating writer, even when he deals with an abstruse subject. His peculiar gifts are exemplified in an article "Through Matter to Mind," reprinted in *The Living Age* for September 9th from *The Contemporary*, in which he marshals some of the arguments of Theism against the negations of science.

CONSTANT-SPEED INDUCTION MOTORS.—Circular No. 200 of the Commercial Electric Company, Indianapolis, Ind., has for its subject a line of induction motors for constant speed, which this company is now placing on the market. In the design of these motors the services were retained of Mr. H. M. Hobart, of London, well known as an authority on polyphase design.

NERNST LAMPS.—The last issue of the "Nernst Central Station Bulletin" contains an interesting article on "The Use of the Nernst Lamps as a Peak Broadener," which suggests the establishment of a two-rate system providing for a high rate during peak hours and a low rate during other hours. Such a system would work to the advantage of all concerned when high-efficiency Nernst lamps are used.

JENNEY MOTOR DRIVE.—Bulletin No. 201 of the Jenney Electric Manufacturing Company, Indianapolis, Ind., illustrates a Jenney motor drive applied to a large flat-bed printing press. The motor is of the Jenney Universal type and is provided with special windings to meet the conditions under which it is to operate, and especially to take care of vibrations incident to the operation of a flat-bed printing press.

LIGHTING SPECIALTIES.—The H. T. Paiste Company, Philadelphia, Pa., has issued bulletin No. 25, dealing with panel boxes, cut-outs and entrance switches. The panel boxes are made of wood and lined throughout with asbestos board, and are of simple but pleasing design. The cut-outs

and entrance switches are provided with porcelain bases, and are characterized by durability of parts and neatness of appearance.

TELEPHONE SWITCHBOARDS.—The Kellogg Switchboard & Supply Company is distributing a neat folder presenting some "Kellogg Facts" which serves to call attention to the pioneer work of the company. The company announces that it can fill the present demand for party-line service by its harmonic system, which does away entirely with all ground connections at the subscriber's station.

BARRIETT GENERATORS AND MOTORS.—Bulletin No. 4 of the Barriett Electric Manufacturing Company, Cincinnati, O., illustrates by excellent half-tones printed in color the various types of the Barriett motor. The frontispiece is a portrait of the late S. L. Barriett, the caption stating that he was the inventor of the self-oiling bearing and the automatic starting release rheostat, two inventions now employed on all modern electric motors.

CRANE VALVES.—The July and August Advance Circulars of the Crane Company, Chicago, are devoted respectively to butterfly hot water radiator valves and combination back pressure and exhaust relief valves. The former valve is operated by the foot, a quarter turn opening or closing the steam passage. The back pressure and exhaust relief valves are for condensing or non-condensing engines and are made in horizontal, vertical and angle patterns.

FLANGED PIPE JOINTS.—The Crane Company, Chicago, Ill., has issued bulletin No. 7FJ, which is characterized as a brief treatise concerning the merits of the various styles of joints used in attaching flanges to wrought pipe. There are described in detail screwed joints, "Cranelap" joints, "Craneweld" joints, shrunk joints, rolled joints and shrunk and riveted joints. Each joint is dealt with thoroughly and the advantages and disadvantages of each are pointed out.

NORTHERN VERTICAL MOTORS represent the most recent developments in electrical equipment for vertical shaft drive. The Northern designers have eliminated the trouble due to lubrication of the vertical shaft. The equipments supplied by the Northern Electrical Manufacturing Company, Madison, Wis., are so arranged that there will be no trouble due to oil spilled from the bearings falling on the commutator and the driven machine. Bulletin No. 50 illustrates some novel arrangments of Northern Vertical motors.

ELECTRICAL AND STEAM MACHINERY.—Bargain List No. 4 of Joseph H. Thompson, Jr., 11 Broadway, New York, contains 12 pages of closely printed items descriptive of bargains in new and second-hand electrical and steam machinery. Among the various classes listed are direct-connected and alternating-current units, belted direct-current and alternating-current generators and motors for all standard voltages, arc dynamos, arc lamps, railway motors and cars, steam engines, both simple and compound, and boilers.

MOTOR-DRIVEN MACHINES.—The Electro-Dynamic Company, Bayonne, N. J., utilizes circular No. 13 to outline the advantages of individual motors for driving machine tools and points out the features of the inter-pole, variable-speed motors which render them especially adapted to this class of work. It will be recalled that these motors are equipped with ball bearings for the purpose of giving a high efficiency and insuring smooth running. It is stated that the bearings require a little vaseline twice a year, no other attention being necessary.

GAS PRODUCERS.—In an artistically prepared catalogue entitled "Morgan Continuous Gas Producer," much information of value is presented to all who are interested in economical ways of generating and applying heat. The details of tests made by Robt. W. Hunt & Company, showing an average efficiency of 92 per cent. are given, and the points of the producer that made possible this efficiency are set forth. The pamphlet, 6x9, 50 pages with embossed cover and numerous illustrations, is issued gratis by the Morgan Construction Company, 40 Exchange Pl., New York.

DE VEAU TELEPHONES.—The De Veau Telephone Manufacturing Company has issued the 12th edition of its catalogue of standard telephone apparatus and standard wiring diagrams. All of the various types of De Veau apparatus are illustrated and described, directions are given for the installation of intercommunicating telephones and wiring diagrams are printed covering every class of interior telephone connection apt to be made. The same company has issued a smaller catalogue devoted specifically to the De Veau automatic switchless intercommunicating telephone, which is shown in a number of wall and desk types.

DISTRICT STEAM HEATING.—In a catalogue which ranks with the edition de luxe type of this class of publication, the American District Steam Company, Lockport, N. Y., sets forth the principles of district steam heating, its merits as a business enterprise and describes in detail all of the various apparatus and devices employed in connection therewith. The publication has rather the character of a treatise on the subject than that of an ordinary catalogue. The commercial and engineering features are brought out, plans of distribution systems given, and a section is devoted to methods of charging for heat service.

ELECTRIC TRUCKS.—No. 50 of the "Record of Recent Construction," a serial publication of the Baldwin Locomotive Works, is devoted to electric motor and trailer trucks. This handsome pamphlet comprises 32 pages, in which the left-hand pages are devoted to excellent half-tone cuts of motor trucks printed on a tinted background. The data of 13 types of motor and trailer trucks are given. There is no descriptive matter, the text opposite the illustration showing the type consisting of very complete data of the main dimensions of the truck, the dimensions of the material used in its construction, of the wheels and axles and of the springs. With one exception the illustrations are made from trucks furnished to various railway companies.

CENTRAL STATION PERIODICAL.—The latest addition to the ranks of central stations issuing a periodical having for its purpose the extension of business and to convey to consumers electrical information likely to interest them, is the Union Light & Power Company of St. Louis. The title of the publication is "Electric Light and Power," and it is made attractive by the use of three-color illustrations. The issue for August gives details concerning the electrical features of the Tyrolean Alps electrical installation at the World's Fair, and contains articles and notes on alternating current motors for elevators and refrigeration, sign board lights and electricity at home. Brief descriptions are also given of a motor-driven machine shop, of a large hotel and of a manual training school.

OIL FILTER CATALOGUE.—We have recently received from the Burt Manufacturing Company, of Akron, O., a very handsome catalogue which describes in detail the various oil filters and exhaust heads manufactured by this company. It illustrates and describes the "Cross," "American" and "Warden" oil filters, the "American" Oil Filtering System and the "Burt" and "Standard" exhaust heads. The valuable information which it contains in reference to the filtering of oils makes it a valuable work of reference, worthy a place on the desk of anyone operating a power plant. It also describes fully the "unit type" of oil filters, which is used in connection with the American oil filtering system. Everyone interested in the running of a power plant is invited to write the Burt Manufacturing Company, Akron, O., for a copy of this handsome publication.

SMALL SINGLE-PHASE INDUCTION MOTORS.—The Emerson Electric Manufacturing Company, St. Louis, Mo., has issued Bulletin No. 3105, describing a line of ⅛-hp. and 1-6-hp. single-phase induction motors designed for starting automatically under full load. Each motor is provided with a squirrel-cage secondary winding, and is equipped with two primary windings, the main coil and the starting coil. The motor is started as a split-phase machine. It is stated that each motor is carefully tested on the proper load, and before leaving the testing room is required to operate under an overload at least 20 per cent. greater than the rating. The motors are constant-speed machines. Two or three speeds of the driven machines may be obtained, however, by the use of 2-step or 3-step cone pulleys. Bulletin No. 3952 of the same company describes a complete line of such pulleys for both flat and round belts.

GENERAL ELECTRIC TRADE LITERATURE.—The extensive publishing business of a large manufacturing company conducted along modern lines is made evident in some indexes just issued by the General Electric Company. These comprise indexes to bulletins, descriptive catalogues, pamphlets, supply catalogues, flyers and price-lists. The subjects of the many hundred of publications entered in these indexes cover almost the entire range of modern electrical application, aside from telephony, telegraphy and storage batteries. This range is illustrated by the following partial list of subjects of bulletins and other publications issued during the month of July: Service cut-out; electrically-driven turbine house pumps; Thomson recording wattmeter, type "C"; pendant switches; porcelain ceiling boards; Edison socket ring; enclosed fuse cut-outs; combination service switch and cut-out in iron box; combined switch and enclosed fuse cut-out for car lighting; ceiling rosette with enclosed fuse; double-pole knife switches; motor controlling rheostats; arc lamp hangers and cut-outs; type "H" oil transformers.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED AUGUST 15, 1905.

[Conducted by Rosenbaum & Stockbridge, Patent Attys., 140 Nassau St., N. Y.]

797,015. INDUCTION ARRESTER; Edward C. Paramore, Philadelphia, Pa. App. filed Dec. 1, 1904. In order to avoid the effect of induction from outside wires in a telephone circuit, a pair of primary coils are wound on a single spool, and a secondary coil is placed in circuit with one of said primary coils. The device is placed in the telephone line intermediate the usual induction coil and the receiver.

797,048. CIRCUIT BREAKER; Harry P. Davis and Arthur B. Reynders, Wilkinsburg, Pa. App. filed Feb. 27, 1904. May be utilized as an automatic circuit breaker or as a circuit closing switch. Each of the arms is independently operable by an independent toggle joint. Both or either one of the toggles may be tripped to actuate the circuit breaker.

797,049. ELECTRICAL TERMINAL CONNECTION; Isaac DeKaiser, Wilkinsburg, Pa. App. filed Nov. 21, 1903. A method of securing the terminals of any apparatus, consisting of a split block having an annular chamber therein which is clamped around a section of the wire having a ring or beading formed thereon.

797,050. INSULATOR; William W. Dunsmore, Falconer, N. Y. App. filed Aug. 24, 1904. The insulator comprises a two-part plug having a zig-zag groove therethrough. The plug is screwed through the cross arms in the direction of the wire, which is led through the zig-zag recess.

797,054. FUSE TERMINAL; Howard W. Gibbs, Newburyport, Mass. App. filed Dec. 9, 1904. A fuse plug comprising a tube of insulating material in which is a packing material and the fusible conductors. The terminals are formed of notched plates which engage flanged collars upon the tube.

797,059. MEANS FOR COOLING PUMP MOTORS; Per J. Hedlund, Stockholm, Sweden. App. filed Jan. 12, 1905. A motor especially adapted for oil pipe lines. The motor is wholly enclosed in an enlargement in the pipe and has openings for the circulation of the oil which cool and lubricate the same.

797,060. CONTROLLER FOR ALTERNATING-CURRENT APPARATUS; Ray P. Jackson, Wilkinsburg, Pa. App. filed Jan. 23, 1905. (See Current News and Notes.)

797,061. CONTROLLER FOR ELECTRIC MOTORS; Ray P. Jackson, Wilkinsburg, Pa. App. filed June 6, 1904. (See Current News and Notes.)

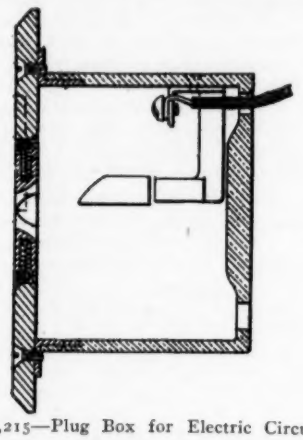
797,065. ELECTRIC SWITCH; Benjamin S. Luther, Boston, Mass. App. filed Apr. 4, 1904. A circuit-breaker for heavy currents in which the contact blades are on a plunger at the rear of the panel board. A lever extending through the board clamps the plates firmly on their contacts by a toggle joint action. Supplemental carbon breaks are provided.

797,090. LAMP SOCKET; William Uschmann, Schenectady, N. Y. App. filed June 1, 1904. A socket has a revoluble sleeve upon which are contact rings or segments. When the lamp is turned the circuit therethrough is made or broken.

797,103. ELECTRIC CLOCK; Martin Fischer, Zurich, Switzerland. App. filed Nov. 20, 1903. In order to synchronize the secondary with the master clocks, each secondary clock is set to gain slightly and a mechanical device is provided to stop the secondary clock at certain intervals, for example, every minute, by which it is made to synchronize with the master clock.

797,110. STORAGE BATTERY; Gustave K. Hartung, New York, N. Y. App. filed April 30, 1904.

797,112. PROCESS OF CONVERTING OLEIC ACID INTO STEARIC ACID; Alexander de Hemptinne, Ghent, Belgium. App. filed Feb. 7, 1905.



797,215—Plug Box for Electric Circuits.

797,141. BLOCK SIGNAL SYSTEM FOR ELECTRIC RAILWAYS; Frank R. McBerty and Malcolm E. Launbranch, Chicago, Ill. App. filed Sept. 9, 1904. In order to admit only one car to a single track section at a time, a contact disk is stepped around by the entrance of the car into the block, and pressure spring is made to overtake the same when the car leaves the block. Quick acting magnets are used which serve to open the circuit of the corresponding instrument at the other end, so that the entrance of two cars into the block from opposite ends at the same time will be prevented.

797,169. SPACE TELEGRAPHY; Ferdinand Braun, Strassburg, Germany. App. filed Feb. 6, 1899. (See Current News and Notes.)

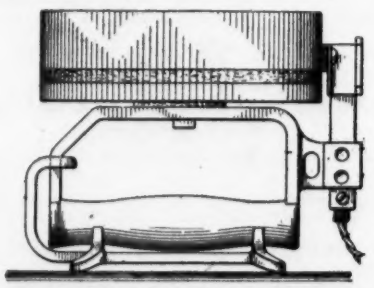
797,180. ELECTRICAL SAFETY APPARATUS FOR SIGNALING ON RAILWAYS; Henri Cousin, Paris, France. App. filed Apr. 3, 1905. In order to enforce caution signals, an apparatus is provided for making a train stop absolutely effective when a danger signal is passed, but which allows the train to pass the train stop in case of a caution signal, if the engineer blows his whistle to indicate that he is on the look-out.

791,187. CAR SIGNAL; Frederic H. Ensign, Los Angles, Cal. App. filed Sept. 20, 1904. In order that a motorman may be informed of the movements of the car ahead, a reflector is used in connection with the rear signal lamp which makes certain movements when the brakes are applied, and at other times, and thereby produces a prearranged signal.

797,191. RAILROAD TRAIN SIGNAL; Samuel E. Foreman, Paducah, Ky. App. filed Mar. 28, 1905. A pair of trolley conductors are led along the track and each train carries contact rollers to make a complete circuit. When the resistance of such circuit falls below a certain amount by virtue of the trains coming too closely together, gun powder is exploded to warn the engineers.

797,215. PLUG BOX FOR ELECTRIC CIRCUITS; Henry G. Osborne and Edward Richter, New York, N. Y. App. filed May 23, 1904. A plug box having a pair of spring doors on its front face which are deflected inward when the plug is inserted and close after the same so as to exclude dust and moisture. When the plug is withdrawn the doors again automatically open and close.

797,217. OPERATING MECHANISM FOR CONTROLLERS; William D. Pomeroy, Norwood, O. App. filed Dec. 8, 1903. In order to avoid



797,226.—Combination Flatiron and Stove.

sparking of the contacts, the control cylinder is not rigidly attached to its handle, but has a loose connection with an intervening spring. As the handle is turned the cylinder follows with a series of quick movements which eliminate injurious sparking.

797,226. COMBINATION FLAT IRON AND STOVE; Earl H. Richardson, Ontario, Cal. App. filed Dec. 19, 1904. An electric flat iron having a heating coil, and also having an arrangement by which it can be turned upside down to constitute a stove.

797,252. ELECTRIC SWITCH; Milan V. Ayres and Daniel E. Hennessy, Everett, Mass. App. filed Feb. 9, 1905. The trolley wire has a tube in which is contained a quantity of mercury, and when the wire is deflected by the passage of a car, the mercury breaks contact with one or another terminal immersed therein.

797,254. MEANS FOR TRANSMITTING ELECTRICITY TO VEHICLES ON ELECTRIC RAILWAYS; Attilio Beer, Venice, Italy. App. filed Aug. 18, 1902. The current is supplied from boxes buried in the roadbed at predetermined intervals, to a conductor extending the length of the train and carried thereby. The boxes are normally closed by a cover which is raised by a mechanical attachment while the train passes.

797,271. ELECTRIC SWITCH; Gano S. Dunn, East Orange, N. J. App. filed Aug. 25, 1903. In order to avoid the excess current in a motor armature while the field cores are building up, an air cylinder is arranged to momentarily cut in resistance after each movement of the controller arm.

797,324. SAFETY FUSE; Joseph Sachs, Hartford, Conn. App. filed Dec. 10, 1903. A tube of insulating material has metallic caps at each end to which the fusible material is secured, and additional caps which lie over the same and protect the whole.

797,325. SAFETY FUSE; Joseph Sachs, Hartford, Conn. App. filed Dec. 18, 1903. In order to more securely connect the parts together, the same screws which secure the end caps in place are effective to hold the terminals of the conductors within the tube.

797,342. TROLLEY WHEEL; Frank E. Bryan, Niles, O. App. filed Dec. 24, 1904. The trolley wheel has spiral grooves on the periphery thereof which serve to lead the conductor back into place when it has jumped out of position.

797,355. TROLLEY MOUNTING; George E. Henry, Vincennes, Ind. App. filed Nov. 9, 1904. The bearings for the wheel in the harp are made hollow and filled with graphite for the purpose of lubrication.

797,369. WATER RHEOSTAT; William D. Pomeroy, Norwood, O. App. filed Dec. 1, 1903. The cover of the box has triangular metallic blades which dip into the water to varying amounts so as to secure a greater or less resistance.

797,394. THIRD-RAIL GUARD; Melchior Zugermayer, East Rutherford, N. J. App. filed Apr. 19, 1905. The third rail is protected by a covering open only at one side. A sliding wall is arranged to close this side except when displaced by the passage of a car.

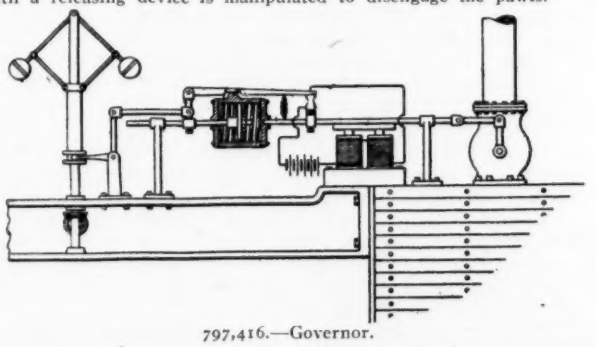
797,396. ELECTRIC MOTOR; Ralph E. Barker, Lynn, Mass. App. filed Oct. 26, 1903. For the purpose of preventing the field coils of small fan motors from sagging down at their unsupported end portions, wires are bent so as to project under the same.

797,398. ELECTROFLUID PRESSURE SWITCHING MECHANISM; Walter J. Bell, Los Angeles, Cal. App. filed Aug. 25, 1904. The switchpoint is moved in either direction by a pneumatic cylinder having an ordinary D valve. The valve is swung backward and forward by a pair of solenoid magnets.

797,416. GOVERNOR; William L. R. Emmet, Schenectady, N. Y. App. filed Mar. 27, 1901. The engine valve is connected with the governor by a dash pot mechanism which causes the closure of the valve to lag considerably behind the movements of the governor. The effect is to avoid the recurring oscillations of alternators in parallel.

797,424. ELECTRIC FIRE ALARM APPARATUS; Eugene Fuller, Arctic Center, R. I. App. filed Jan. 28, 1905. Relates to fire alarms in which a signal lamp is displayed. When the lamp has once been displayed by an enunciator or other means, a local circuit is closed which maintains the current until the latter is cut off by an authorized person.

797,433. ELECTRIC SWITCH; Edward M. Hewlett, Schenectady, N. Y. App. filed Nov. 4, 1904. The controller arm has a pair of pawls thereon which engage notches and hold the arm after each step or movement, until a releasing device is manipulated to disengage the pawls.



797,416.—Governor.

797,454. ATTACHMENT PLUG; Henry T. Paiste, Philadelphia, Pa. App. filed Jan. 20, 1904. The usual corrugated shell which constitutes the threaded portion of the plug is telescoped on to a smooth cylindrical part with a recess in which cement is flowed.

797,457. CONDUIT THREADER; Charles B. Rodgers, Bordentown, N. J. App. filed Mar. 25, 1904. The conduit threader has a grappler thereon which can be manipulated by the movement of a cord to remove obstructions from the interior of a conduit.

797,472. ATTACHMENT PLUG; George B. Thomas, Bridgeport, Conn. App. filed Feb. 3, 1905. A cylindrical insulator carries a threaded shell which is held in place thereon by its flanged end which is clamped beneath the base of the insulator.

797,490. INSULATED RAILWAY RAIL JOINT; Bancroft G. Braine, Brooklyn, N. Y. App. filed July 23, 1902. The two ends of an insulating fish plate are offset from one another so as engage opposite sides of the rail. The connecting web goes between the abutting ends of the rail section.

797,498. BLOCK SIGNAL SYSTEM; Fred B. Corey, Schenectady, N. Y. App. filed Jan. 21, 1905. A semaphore arm is driven by a motor into two extreme positions which correspond to danger and safety respectively. Circuits are provided by which the caution circuits stop the motor at an intermediate point so as to hold the semaphore arm half way raised.

797,517. MEASURING INSTRUMENT; John H. Kimball, Lynn, Mass. App. filed Aug. 25, 1904. Relates to the journal bearings of the rotating member in a meter and is designed to prevent vibration and looseness. The bearings are spring-pressed toward one another and one of the engaging surfaces is of a non-metallic material.

797,518. SYSTEM OF ELECTRICAL DISTRIBUTION; Sigvald Krohn, Berlin, Germany. App. filed Nov. 2, 1899. Is designed to secure constant potential without resort to over-compounding the generator. A motor in the working circuit works against the tortion spring so that its angle of movement varies with the power. The motor is connected to a switch which throws storage batteries into circuit when the load falls off.

797,526. SWITCH; Frank R. McBerty, Evanston, Ill. App. filed Dec. 21, 1903. In order to avoid mistakes the end of a telephone spring jack is closed in such a way that the plug cannot be inserted therein unless it is specially formed with a sort of key adapted to that particular spring jack.

797,544. SPACE TELEGRAPHY; Ferdinand Braun, Strassburg, Germany. App. filed Feb. 6, 1899. (See Current News and Notes.)